CHAPTER 4. CONSERVATION HABITATS & SPECIES ASSESSMENTS

A. Terrestrial Habitats (List by ecoregion found in Appendix G)

1. Agriculture - Crop – Grassland

Rarity Rank: N/A
Synonyms: None
Ecological Systems: None

General Description:

This is a general category made up of diverse land cover and land use features of altered habitats resulting from human activity. These areas occur in every ecoregion throughout the state. The land cover types may include all or some of the following:

- Scattered woody and herbaceous vegetation representing orchards (pecan, citrus, etc.), vineyards, experimental plots, plant nurseries, roadway rights-of-way
- Row and cover crops consisting of various grain crops, cotton, sweet potatoes, soybeans, rice and sugarcane
- Fields that have been tilled or untilled containing exposed or partially exposed soil
- Fallow fields or areas which have been left idle during the growing season
- Utility rights-of-way
- Grasslands dominated by perennial graminoid plants (primarily pastures and/or rangelands)

Some species of wildlife benefit from agricultural production. Historically, agricultural practices and the type of crops produced were highly varied, and this provided a habitat diversity that favored numerous species. As this habitat became less diverse as a result of changing agricultural practices and larger tracts in production, the habitat quality declined for many species of wildlife. This was particularly true for resident and breeding edge/grassland species such as northern bobwhite, eastern bluebirds, dickcissels, rusty blackbirds, and many species of sparrows. In addition, the value of this habitat for birds migrating across these habitats has diminished.

Within this habitat type, there may be patches of “natural” habitat such as vegetated streamsides, embedded wetlands, and small blocks of forest which can serve as important breeding, dispersal, and travel corridors for various wildlife species when sufficiently large. While no species of conservation concern are dependent upon these habitats for survival per se, they often support some of the highest concentrations of these resident and migratory species. For example, flooded rice fields and crawfish ponds are extremely important to shorebirds, wading birds, and waterfowl. These fields are integral

components of the Lower Mississippi Valley Joint Venture (LMVJV) and Gulf Coast Joint Venture (GCJV) plans for meeting the needs of shorebirds, wading birds, and waterfowl. Similarly, grain crops can support the highest populations of northern bobwhite and wintering sparrows when good field borders are incorporated into the farming operation. In fragmented habitats, conservation features on agricultural lands may serve to connect patches of natural habitat. Irrigation ditches are heavily used by wading birds and crustaceans, fencerows serve as breeding sites for some songbirds, and wooded drainages can serve as travel corridors for mammals, especially the Louisiana black bear.

Current Extent and Status:

There are approximately 7.8 million acres of farm land in Louisiana (Farmland Information Center 2004). Working agricultural landscapes can be greatly enhanced with proper planning. The Federal Farm Bill offers some of the greatest opportunities for these enhancements to occur because of the sheer magnitude of the dollars associated with farm programs. Typically cost-share, incentive payments, or both are provided to qualified participants. Invasive species such as *Triadica sebifera* (Chinese tallow tree) can be a problem on areas where no management is conducted.

AG – CROP - GRASSLAND **SPECIES OF CONSERVATION CONCERN (49)**		
AMPHIBIANS	American Woodcock	Falcate Orangetip
Strecker's Chorus Frog	Short-eared Owl	Reakirt's Blue
Southern Crawfish Frog	Scissor-tailed Flycatcher	Little Metalmark
	Sedge Wren	Creole Pearly Eye
BIRDS	Sprague's Pipit	Southern Dogface
American Bittern	Loggerhead Shrike	
Wood Stork	Painted Bunting	**CRUSTACEANS**
Mottled Duck	Dickcissel	Sabine Fencing Crawfish
Northern Pintail	Field Sparrow	Ouachita Fencing Crawfish
Northern Harrier	Grasshopper Sparrow	
Northern Bobwhite	Henslow's Sparrow	**MAMMALS**
Yellow Rail	Le Conte's Sparrow	Southeastern Shrew
Black Rail	Smith's Longspur	Eastern Harvest Mouse
Clapper Rail	Rusty Blackbird	Louisiana Black Bear
King Rail		Long-tailed Weasel
Sandhill Crane	**BUTTERFLIES**	Eastern Spotted Skunk
Whooping Crane	Wild Indigo Duskywing	
Marbled Godwit	Cobweb Skipper	**REPTILES**
Dunlin	Dusted Skipper	Western Slender Glass Lizard
Short-billed Dowitcher	Yucca Giant Skipper	Gopher Tortoise

Priority Species Research and Survey Needs:

Southern Crawfish Frog: Present occurrence poorly known in Louisiana; known to exist on agricultural lands in adjacent states. Determine current use of agricultural lands by crawfish frogs in Louisiana, and determine which land practices enable persistent use by frogs.

Mottled Ducks: Research is needed on nesting success, brood rearing and brood success rates, molting habitat needs, and annual recruitment and survival rates along with other basic research to determine breeding and recruitment constraints.

Loggerhead Shrike: Monitoring of distribution, reproductive success, and evaluation of nesting habitat in Louisiana.

Rusty Blackbird: Initiate surveys to determine wintering population abundances and habitat use to augment Christmas Bird Counts.

Rails: Initiate intensive surveys to determine population densities and distributions in rice and crawfish farm habitats.

Species Conservation Strategies:

1. Shorebirds:
   - Work with landowners (especially rice and crawfish farmers) to implement management and conservation recommendations for waterbirds (especially rails) of SWG project T18 upon completion and USFWS waterbird management plan.
   - Partner with LMVJV, GCJV, USFWS and other interested groups to encourage farmers to manage water levels to provide habitat for shorebirds during migration, with an emphasis on early fall migration.
2. Early Successional Bird Species: Continue to encourage landowners to maintain areas in early successional stage to benefit these species.
3. Northern Bobwhite and Grassland Birds: Support implementation of recommended habitat restoration actions specified in Northern Bobwhite Conservation Initiative (NBCI) and by LDWF quail and grassland bird task force.
4. Partner with LSU and University of Louisiana, Lafayette (ULL) to develop/update management guidelines/Best Management Practices (BMPs) for species of conservation concern that occur in lands cultivated for rice and sugarcane.
5. Promote safe and cost effective fire ant control and reduction of other plant and animal exotics on agricultural lands.

Threats Affecting Habitat:

1. Incompatible management practices and invasive species are the main threats to this habitat.
2. Expansion of sugarcane into the rice/prairie region of southwest Louisiana.
3. Clean framing practices which include the removal of hedgerows and fencelines.

Habitat Conservation Strategies:

1. Encourage planting of native species along field borders and filter strips to create micro-habitat for wildlife species (CP33 – NRCS program, habitat buffers for upland birds).
2. Encourage the development of "soft or feathered" edges on the agricultural landscape through natural succession, planting of native grasses, legumes and forbs, and small shrubs (plum thickets, blackberry, etc.) when appropriate, and management to maintain these habitats.
3. Encourage management of fallow fields to maintain early succession and to prevent invasion of woody shrubs and trees.
4. Encourage planting of native grasses and proper timing of mowing and haying to prevent destruction of borrows and nests in grasslands and rights-of-way.
5. Work with farmers, state (LDEQ, LDNR) and federal (NRCS, USGS) agencies, university extension services, local and parish governments, and the legislature to develop a comprehensive statewide water rights/use plan.
6. Provide farmers with information on federal/state incentive programs.
7. Secure funding for a position whose sole purpose is Farm Bill Programs/Agricultural Liaison.
8. Secure funding for LDWF positions to be located at NRCS regional offices to provide wildlife recommendations to NRCS District Conservationists as they develop farm conservation plans.
9. Actively participate in NRCS state technical advisory committee (TAC).
10. Develop and distribute promotional materials on federal/state incentive programs beneficial to wildlife geared towards farmers and NRCS/Farm Service Agency (FSA) personnel.
11. Partner with LSU Agriculture Extension to develop and implement strategies in this habitat.
12. Provide information on CWCS target species and habitats for teacher and other workshops (Future Farmers of America (FFA), Envirothon, etc.) to ensure their use in Louisiana schools.

References:

FARMLAND INFORMATION CENTER. 2004. Website. http://www.farmlandinfo.org

2. Barrier Island Live Oak Forest

Rarity Rank: S1/G1
Synonyms: Maritime Forest
Ecological Systems: CES203.513 Mississippi Delta Maritime Forest

General Description:

This barrier island community is currently restricted to Grand Isle, Jefferson Parish, Louisiana, where it occupies a small area (less than 1,000 acres). All known occurrences are impacted by development, exotic species, clearing of understory vegetation, and habitat fragmentation. This community appears to be distinct from other *Quercus virginiana* (live oak) communities occurring to the east and west, but little is known about this habitat type. It is dominated by *Quercus virginiana*, with a minor component of *Celtis laevigata* (hackberry). *Zanthoxylum clava-herculis* (toothache tree), *Diospyros virginiana* (persimmon), *Gleditsia triancanthos* (honeylocust), and *Morella cerifera* (waxmyrtle) are typical associates (LNHP 1986-2004, West 1938, Brown 1930). Trees in this habitat type can exhibit the effects of saltwater spray and wind, having a stunted appearance and leaning away from the prevailing wind (West 1938, Brown 1930).

Current Extent and Status:

There is no complete information regarding the presettlement extent of this natural community type on Louisiana's barrier islands. The last remaining barrier island live oak forest in Louisiana occurs on Grand Isle. TNC's Lafitte Woods Preserve protects 13 acres of this forest and TNC helped restore 30 acres by planting live oak and hackberry trees on property owned by ExxonMobil. The Orleans Chapter of the Audubon Society (OAS) has proposed a bird sanctuary on an additional 17 acres (the Sureway Woods) and is currently raising funds to purchase this property.

BARRIER ISLAND LIVE OAK FOREST SPECIES OF CONSERVATION CONCERN (4)	
BIRDS	**REPTILES**
Yellow-billed Cuckoo	Eastern Glass Lizard
Painted Bunting	
Orchard Oriole	

Priority Species Research and Survey Needs:

Eastern Glass Lizard: Not observed at outlying Grand Isle population in nearly 30 years, despite adequate habitat. Conduct surveys to determine if Grand Isle population is extant.

Species Conservation Strategies:

1. Migratory Birds: Continue efforts to support conservation of remaining habitat.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat			
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Commercial/ industrial development		XXX		XXX
Development/maintenance of pipelines, roads or utilities		XXX	XXX	
Invasive/alien species	XXX			
Recreational use/vehicles		XXX	XXX	
Residential development		XXX	XXX	
Shoreline erosion				XXX

Habitat Conservation Strategies:

1. Partner with NGOs (TNC, Louisiana Ornithological Society (LOS), National Audubon Society (NAS)), state and federal agencies, industry, and private landowners to promote conservation of remaining barrier island live oak forests.
2. Work with the legislature to develop tax incentives and conservation servitudes or leases for landowners to encourage conservation of this habitat type.

3. Promote planting of live oak and other native tree species.
4. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamplets and the LDWF website.
5. Support NRCS and Louisiana Department of Natural Resources (LDNR) efforts for shoreline stabilization and habitat restoration.
6. Work with LCA, Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) to broaden the extent of coastal restoration projects.
7. Work with local governing boards to recommend limits on All Terrain Vehicles (ATVs) in this habitat.
8. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.
9. Work with NRCS Plant Materials Center, Barataria-Terrebonne National Estuary Program (BTNEP),and Office of State Parks (OSP) to develop restoration program for this habitat.

References:

BROWN, C. A. 1930. Plants observed on an excursion to Grand Isle, Louisiana. Bulletin of the Torrey Club 57:509-513.

LNHP. 1986-2004. The natural communities of Louisiana. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

NATURESERVE. 2005. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.2. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: June 8, 2005).

SMITH, L. M. 1993. Estimated presettlement and current acres of natural plant communities in Louisiana. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

WEST, E. M. 1938. The vegetation of Grand Isle. The Louisiana Academy of Sciences 4:214-217.

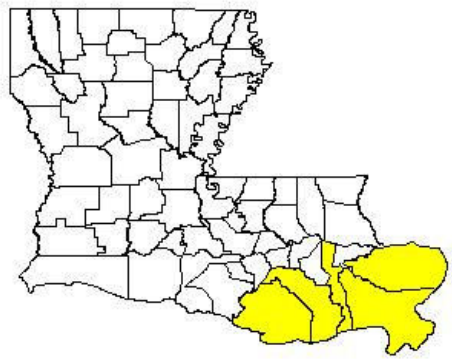
3. Barrier Island

Rarity Rank: N/A
Synonyms: None
Ecological Systems:
CES203.469 Louisiana Beach
CES203.471 Southeastern Coastal Plain Interdunal Wetland

General Description:

Louisiana's coastal Barrier Islands are important breeding and nesting habitat for migratory shorebirds and colonial nesting waterbirds. The islands are not classified as a single natural community due to the fact that they are comprised of several habitat types including: Coastal Dune Grasslands, Coastal Dune Shrub Thickets, and Coastal Mangrove-Marsh Shrubland. Marine Submergent Aquatic Vegetation also occurs in bays behind these islands. Predominant plant species include: *Spartina patens* (marshhay cordgrass), *Spartina alterniflora* (smooth cordgrass), *Sporobolus virginicus* (coast dropseed), and *Avicennia germinans* (black mangrove). Species distribution is determined by elevation gradients and exposure to saltwater spray or tidal overwash. Generally, succulent species and vines are found on the beach fronts, wiregrass on highest dunes, and black mangrove and smooth cordgrass on the sheltered bayside areas.

Current Extent and Status:



Barrier islands in Louisiana are old shorelines of abandoned, eroding deltas of the Mississippi River. Since deltaic processes have been altered due to the leveeing of the Mississippi River, we can expect no new barrier islands to form. The current major barrier islands include the Chandeleur Island chain, Grand Isle and Grand Terre, Timbalier Islands, and Isle Dernieres. Louisiana's barrier islands are much younger and geologically less resistant than non-deltaic barrier islands of adjacent states. Major efforts are being made to preserve and protect these islands from tropical storm impacts. These include the use of breakwaters to buffer wave action, pumping of material from back bay areas

and sand fencing and planting of vegetation along beaches to anchor sand and stabilize the substrate.

Several barrier islands or portions of islands fall within conservation areas. Much of the Chandeleur chain is captured by Breton NWR, which was established in 1904 and is the second oldest refuge in the national refuge system. Isle Dernieres Barrier Islands Refuge, managed by LDWF, includes Wine, Whiskey, East, Trinity, and Raccoon Islands. Grand Isle is the only inhabited barrier island and as a result, much of the natural habitat is altered. However, examples of native habitats are preserved on sites such as the Lafitte Woods Preserve, managed by TNC, which protects a live oak forest, and Grand Isle State Park which captures beach, coastal dune shrub thicket, and salt marsh habitats.

BARRIER ISLANDS SPECIES OF CONSERVATION CONCERN (23)		
BIRDS	Dunlin	**BUTTERFLIES**
Brown Pelican	Short-billed Dowitcher	Obscure Skipper
Reddish Egret	Gull-billed Tern	Eastern Pygmy Blue
Yellow-crowned Night-Heron	Caspian Tern	
Snowy Plover	Royal Tern	**REPTILES**
Wilson's Plover	Sandwich Tern	Loggerhead Seaturtle
Piping Plover	Common Tern	Kemp's Ridley Seaturtle
American Oystercatcher	Forster's Tern	Leatherback Seaturtle
Marbled Godwit	Black Skimmer	Mississippi Diamondback Terrapin

Priority Species Research and Survey Needs:

Snowy Plover, Wilson's Plover, Piping Plover: Continue to monitor breeding and wintering populations along the coast and on barrier islands.

Reddish Egret and American Oystercatcher: Conduct research to assess the limiting factors on reproduction and the effects of human coastal recreational activities on bird populations. Intensive surveys are needed to accurately determine population levels.

Terns: Conduct research to determine the factors effecting overall population densities and continue with surveys of breeding sites.

Waterbirds: Continue to conduct rookery surveys to update database information.

Obscure Skipper and Eastern Pygmy Blue: Conduct surveys to determine current distribution and abundance for inclusion in LNHP database.

Mississippi Diamondback Terrapin: Population status in Louisiana isunknown. Drastic declines have been documented in other states, but the source of their decline has not been identified. Conduct trawl/nest surveys.

Species Conservation Strategies:

1. Terns:
   - Disturbance and loss of nesting habitat are major threats; develop partnerships to strengthen the protection and restoration of barrier islands.
   - Develop a comprehensive survey methology to determine long term trends in population abundances.
2. Shorebirds, Wading Birds:
   - Provide public education regarding the importance of waterbird nesting colonies and shorebird feeding areas. Reduce the negative effects on these areas from recreational and other uses.
   - Coordinate with GCJV to implement recommendations of shorebird and wading bird conservation plans.
3. Brown Pelican: Continue with long-term monitoring of nesting colonies.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat		
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Fragmentation
Commercial/industrial development		XXX	
Development/maintenance of pipelines, roads or utilities			XXX
Invasive/alien species	XXX		
Recreational use/vehicles	XXX		
Residential development		XXX	
Shoreline erosion			XXX

Habitat Conservation Strategies:

1. Partner with state and federal agencies, NGOs, private landowners, etc. to promote the protection and restoration of barrier islands.
2. Promote education regarding invasive plant species within this habitat and methods to eradicate and/or control invasives.
3. Support NRCS and LDNR efforts for shoreline stabilization and habitat restoration.
4. Work with LCA, CWPPRA to support coastal restoration projects, specifically targeting important nesting areas and species of conservation concern.

5. Work with local governments to recommend limits on recreational vehicle use of this habitat.
6. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.
7. Work with NRCS Plant Materials Center, BTNEP,and OSP to develop restoration program for this habitat.

4. Batture

Rarity Rank: S4S5/G4G5
Synonyms: Riverfront Pioneer, Cottonwood-Willow, Black Willow, Cottonwood.
Ecological Systems:
CES203.190 Mississippi River Riparian Forest
CES203.512 Lower Mississippi River Bottomland and Floodplain Forest
CES203.489 East Gulf Coastal Plain Large River Floodplain Forest
CES203.065 Red River Large Floodplain Forest
CES203.488 West Gulf Coastal Plain Large River Floodplain Forest

General Description:

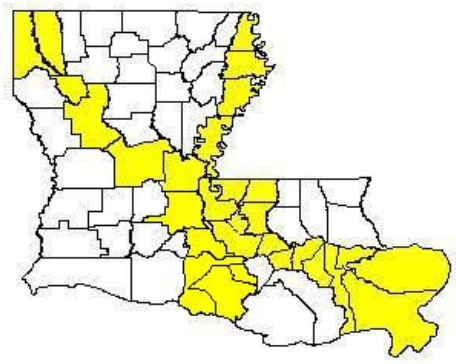
The batture community develops on the slope between the natural levee crest and major streams/rivers. It is a pioneer community which is first to appear on newly formed sand bars and river margins. The area receives sands and silts with each flood. The soils are semi-permanently inundated or saturated. Soil inundation or saturation by surface water or groundwater occurs periodically for a major portion of the growing season. Such conditions typically prevail during spring and summer months with a frequency ranging from 51 to 100 years per 100 years. The total duration of time for the seasonal event(s) normally exceeds 25 percent of the growing season.

Salix nigra (black willow) comprises a majority of the stocking, and *Populus deltoides* (cottonwood) is the primary associate. Secondary species may be, depending chiefly on successional stage, *Betula nigra* (riverbirch), *Fraxinus pennsylvanica* (green ash), *Platanus occidentalis* (American sycamore), *Carya illinoensis* (pecan), *Celtis laevigata* (hackberry), *Acer rubrum* (red maple), *Forestiera acuminata* (swamp privet), *Planera aquatica* (water elm), *Ulmus americana* (American elm), *Taxodium distichum* (baldcypress), *Acer negundo* (box elder) and *Morus rubra* (red mulberry). *Salix exigua* (sandbar willow) may be common in certain sites. Batture is a community undergoing relatively rapid succession. Black willow is a temporary, short-lived pioneer species of very rapid growth. Cottonwood will outgrow willow and become dominant except where frequent and extended growing-season flooding covers the trees and limits its growth. As sediments build up in the community and succession progresses, willow and cottonwood become less dominant and secondary associates gain increasing importance in the community. The community often succeeds into Hackberry-American Elm-Green Ash or Sycamore-Sweetgum-American Elm Bottomland Forest.

The successional sequence is a function of river meander movement rates and point bar formation. Rivers with swift meander movements over unconsolidated sands produce tapered slopes on point bars which are first colonized by the Batture community.

Current Extent and Status:

Batture occurs primarily along the Mississippi River but also along the Atchafalaya, Red, and perhaps other smaller rivers. It is apparently a secure and viable habitat in Louisiana. The acreage and number of intact sites is unknown.



BATTURE SPECIES OF CONSERVATION CONCERN (20)		
BIRDS	Northern Parula	**REPTILES**
Yellow-crowned Night-Heron	Prothonotary Warbler	Ringed Map Turtle
Wood Stork	Swainson's Warbler	Ouachita Map Turtle
Swallow-tailed Kite	Kentucky Warbler	Sabine Map Turtle
Bald Eagle	Hooded Warbler	Pascagoula Map Turtle
American Woodcock	Orchard Oriole	Timber Rattlesnake
Yellow-billed Cuckoo		
Wood Thrush	**MAMMALS**	
Yellow-throated Vireo	Long-tailed Weasel	

Priority Species Research and Survey Needs:

Swallow-tailed Kite: Continue with nesting surveys and monitoring of kites on public and private lands to fill data gaps in distribution and abundance for inclusion in LNHP database and Audubon nationwide database.

Songbirds: Continue to support research on silviculture/land management practices and their effects on all songbird species.

Long-tailed Weasel: Considered vulnerable in Louisiana. Intensive surveys needed to update occurrence records and abundance for inclusion in LNHP database. Document the habitat relationships of the long-tailed weasel and how dependent this species is upon batture habitats, relative to other habitat types.

Species Conservation Strategies:

1. Identify Important Bird Areas (IBAs) or potential IBAs and partner with Baton Rouge Audubon Society (BRAS), OAS, and the NAS to implement conservation recommendations from SWG project T27 upon completion.
2. Swallow-tailed Kite: Implement conservation and management recommendations of SWG project T9 (Coulson 2004).
3. Bald Eagle: Continue with long-term monitoring of active bald eagle nests, successful breeding pairs, and fledged eagles.
4. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS endangered and threatened species recovery plans over the next 10 years.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat					
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Fragmentation	Herbivory	Modification of Water Levels; Changes in Natural Flow Patterns	Toxins/ Contaminants
Borrow pits		XXX	XXX			
Commercial/industrial development		XXX	XXX			
Construction of ditches, drainage or diversion systems		XXX	XXX			
Industrial discharge						XXX
Invasive/alien species	XXX					
Management of/for certain species	XXX			XXX		
Mining practices		XXX	XXX			
Operation of drainage or diversion systems	XXX				XXX	XXX

Habitat Conservation Strategies:

1. Work with city planning commissions and local conservation groups to promote development of batture reserves to retain natural habitats.

2. Work with LDEQ, the Environmental Protection Agency (EPA), and other federal and state agencies to fill data gaps concerning ecological system processes and water quality/discharge impacts on this habitat.
3. Work with COE and local levee boards to maintain the natural ecology of batture areas and to educate these organizations on the productivity of this habitat in meeting the needs of resident and migratory wildlife species.

References:

COULSON, J. O. 2004. Identifying swallow-tailed kite activity centers: determining use of the state of Louisiana managed lands. Final report. Report to Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

LNHP. 1986-2004. The natural communities of Louisiana. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

5. Bayhead Swamp/Forested Seep

Rarity Rank: S3/G3?
Synonyms: Baygall, Reed Brake, Acid Seep Forest, Spring-Head, Green-Head
Ecological Systems: CES203.505 Southern Coastal Plain Seepage Swamp and Baygall
CES203.372 West Gulf Coastal Plain Seepage Swamp and Baygall

***General Description*:**

(Note: Bayhead Swamp and Forested Seep are described as distinct communities in the LNHP Natural Communities of Louisiana. They are considered together here due to their floristic similarity and similarity in management needs.)

Bayhead Swamps are typically densely stocked, often-flooded forested wetlands that develop in broad, shallow, braided drains, or along margins of creeks with little or no creek banks (LNHP 1986-2004, Brooks et al 1993, Guillory et al 1990, Smith 1996). They are also found in relatively deep depressional areas in flatwoods, or in the headwaters of creeks in sandy, acidic uplands across much of the state. They occur on the sandy uplands of western Louisiana in both the Upper and Lower West Gulf Coastal Plains (UWGCP and LWGCP), but are probably most common in the pine flatwoods of the East Gulf Coastal Plain (EGCP) lying on the Pleistocene Terraces that flank the Bogue Chitto River in Washington Parish (Smith 1999). They are seasonally to semi-permanently saturated or flooded.

Forested Seeps occur in northwest, central, and western Louisiana (UWGCP and LWGCP), typically in association with mixed pine-hardwood forests, on hillsides, to the base of slopes. The plant species compostion is very similar to that of bayhead swamps. Forested seeps are continually moist due to constant seepage forced to the surface by an underlying impervious layer (LNHP 1986-2004).

Soils of bayhead swamps/forested seeps are deep, very poorly drained, very strongly acid loamy fine sand, fine sandy loam or silt loam, with relatively high organic matter content. Available water capacity is high, surface runoff is very slow to ponded. Inherent fertility is low. Some typical soils are Myatt fine sandy loam, Guyton silt loam and Osier loamy fine sand (Smith 1996).

The overstory of both bayheads and forested seeps is typically characterized by a closed to nearly closed canopy. The midstory is often densely stocked with various shrubs, many of which are evergreen, and there is often an abundance of ferns, except in the lowest, often-flooded depressions where little herb cover is present, other than

Sphagnum spp., which can form thick mats. These forests naturally vary from a few acres up to more than 100 acres in size (Brooks et al 1993, Smith 1996).

Bayhead swamps generally occupy the lowest positions on the landscape, with the exception of the principal permanent streams that drain the area. They are found just down the topographic gradient from pine and hardwood flatwoods. The highly acidic nature of the soils combined with the abundance of organic muck that accumulates on the swamp floor often produces a "blackwater" (actually tea-colored water) condition in streams associated with bayhead swamps.

Fire probably played a minor role in bayhead swamps because of its topographic position, usually wet nature, and general lack of appropriate fuels to carry a fire. However, fires may have occurred during exceedingly dry periods in broader bayheads, or may have been fairly frequent in narrow bayhead drains. Switch cane (*Arundinaria gigantea*), a highly combustible woody grass, can form dense thickets in bayheads (particularly at their edges, hence the old name "reed brake"), and may have played a key role in the fire dynamics of this community, especially in narrower bayhead drains (Smith 1996).

Magnolia virginiana (sweet bay, often dominant) and *Nyssa sylvatica* (black gum) are the common overstory trees. *Quercus laurifolia* (laurel oak), *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweet gum), *Q. nigra* (water oak), *Taxodium distichum* (baldcypress), *T. ascendens* (pondcypress, in EGCP), *Pinus elliottii* (slash pine, in EGCP), and *P. palustris* (longleaf pine) may be present. A diversity of shrubs or small trees, primarily evergreen, are prevalent in the community. Species that may be present include *Persea borbonia* (red bay), *Cyrilla racemiflora* (swamp cyrilla, in EGCP and southwest Louisiana), *Morella heterophylla* (bigleaf wax myrtle), *M. cerifera* (wax myrtle), *Ilex glabra* (little-leaf gallberry, in EGCP), *I. coriacea* (sweet gallberry, in EGCP and southwest Louisiana), *I. opaca* (American holly), *Lindera subcoriacea* (S1/G2) (bog spicebush, in EGCP), *Lyonia lucida* (fetterbush, in EGCP), *L. ligustrina* (fetterbush), *Leucothoe axillaris* (leucothoe, in EGCP), *L. racemosa* (leucothoe), *Itea virginica* (Virginia willow), *Aronia arbutifolia* (red chokeberry), *Viburnum nudum* (possum-haw viburnum), *Rhus vernix* (poison sumac), *Clethra alnifolia* (summer sweet, primarily in EGCP), *Alnus serrulata* (hazel alder), *Styrax americana* (American snowbell), *Rhododendron serrulatum* (summer azalea), *R. canescens* (wild azalea), *Rhododendron oblongifolium* (wild azalea, central, western, and north Louisiana), and other species. *Smilax laurifolia* (bamboo greenbrier) and *Decumaria barbara* (climbing hydrangea) are often conspicuous community members. Herbaceous flora is usually sparse but may include ferns, such as *Lorinseria areolata* (net-veined chain fern), *Onoclea sensibilis* (sensitive fern), *Osmunda cinnamomea* (cinnamon fern), and *O. regalis* (royal fern), and a few orchid species (LNHP 1986-2004, NatureServe 2005).

Current Extent and Status:

Presettlement extent of bayheads and seeps statewide in Louisiana is estimated to have been 100,000 to 200,000 acres, with only 25 to 50% currently remaining (Smith

1993). Some of these habitats occur on public lands in the UWGCP and LWGCP where they are protected and in most cases, appropriate management is applied. These public lands include KNF, Fort Polk, Barksdale Air Force Base and Bodcau WMA. Bodcau and KNF have a total of 145 acres of a forested seep habitat registered with the Natural Areas Registry Program (one site on each area). Clear Creek and West Bay WMAs, which are in the southwest part of the state, certainly support this habitat but the status of it on these areas is not known. Both of these areas are owned by forest products companies and are leased by LDWF. Also in central and northwest Louisiana there are three privately owned forested seeps totaling 71 acres which are entered in the Natural Areas Registry Program. There is only minimal protection for remaining bayhead swamps in the EGCP. TNC's Abita Creek, Talisheek and Charter Oak Preserves in St. Tammany Parish contain the largest protected areas of bayhead swamps in the Florida Parishes. The combined preserves total 3,928 acres with an unknown number of acres in bayhead swamp and including longleaf pine savannahs and flatwoods, hillside seepage bogs, slash pine-pondcypress/hardwood and riparian forests. In addition, 20 acres are protected within the Bogue Chitto State Park in Washington Parish. There are currently no bayhead properties in the EGCP registered with the Louisiana Natural Areas Registry Program. Today these wetlands are most often found surrounded by commercial timberlands and are affected by management on these adjacent lands. One such bayhead, of 20 acres or less, has been given a "special site" designation by the forest industry owner.

BAYHEAD SWAMP – FORESTED SEEP **SPECIES OF CONSERVATION CONCERN (20)**		
AMPHIBIANS	Northern Parula	**BUTTERFLIES**
Southern Dusky Salamander	Prothonotary Warbler	Pepper and Salt Skipper
Gulf Coast Mud Salamander	Swainson's Warbler	Falcate Orangetip
	Kentucky Warbler	Harvester
BIRDS	Hooded Warbler	
American Woodcock	Painted Bunting	**MAMMALS**
Yellow-billed Cuckoo	Rusty Blackbird	Southeastern Shrew
Wood Thrush	Orchard Oriole	Southeastern Myotis
Yellow-throated Vireo		Long-tailed Weasel

Priority Species Research and Survey Needs:

Southern Dusky Salamander: This species is exhibiting drastic declines in relatively pristine areas throughout its range; its status is not currently being addressed by the Federal government. Initiate status surveys at reference sites to determine the extent of population declines in protected sites.

Pepper and Salt Skipper: Conduct surveys to determine current distribution and abundance for inclusion in LNHP database.

Southeastern Shrew: Considered imperiled in Louisiana, Louisiana represents the western edge of its range together with Arkansas and Missouri. Intensive surveys needed to update occurrence records and abundance for inclusion in LNHP database.

Long-tailed Weasel: Considered vulnerable in Louisiana. Intensive surveys needed to update occurrence records and abundance for inclusion in LNHP database.

Songbirds: Continue to fund monitoring of songbird populations within this habitat type and the effects of forest management on these species.

Species Conservation Strategies:

1. When appropriate, support recommendations by the Ecosystem Management and Restoration Research Program (EMRRP) (Martin 2002).

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat							
Source of Threat	Altered Composition/ Structure	Altered Water Quality	Groundwater Depletion	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns	Sedimentation
Channelization of rivers or streams	XXX			XXX	XXX		XXX	XXX
Construction of ditches, drainage or diversion systems	XXX			XXX	XXX		XXX	XXX
Conversion to agriculture or other forest types				XXX		XXX		XXX
Development/maintenance of pipelines, roads or utilities	XXX			XXX	XXX	XXX	XXX	XXX
Excessive groundwater withdrawal			XXX					
Fire suppression	XXX							
Incompatible forestry practices	XXX	XXX			XXX		XXX	XXX
Invasive/alien species	XXX				XXX			
Recreational use/vehicles	XXX				XXX			
Residential development				XXX	XXX	XXX		XXX

Habitat Conservation Strategies:

1. Work with Louisiana Forestry Association (LFA) to produce a publication for landowners which discusses BMPs for Streamside Management Zones (SMZs) and methods for effective landowner/logger communication.
2. Conduct surveys to determine the current extent and condition of this habitat type.
3. Develop management plans/recommendations for this habitat type.
4. Support research investigating the effects of altered hydrology regimes within this and adjacent habitats.
5. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.

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6. Bottomland Hardwood Forest

Rarity Rank: S4/G4G5
Synonyms: Mixed Bottomland Hardwoods, Broad Stream Margins, Hardwood Bottoms
Ecological Systems:
CES203.512 Lower Mississippi River Bottomland and Floodplain Forest
CES203.489 East Gulf Coastal Plain Large River Floodplain Forest
CES203.065 Red River Large Floodplain Forest
CES203.488 West Gulf Coastal Plain Large River Floodplain Forest

General Description:

Bottomland hardwood forests are forested, alluvial wetlands occupying broad floodplain areas that flank large river systems. These forests are found throughout Louisiana in all parishes, but are the predominant natural community type of the Mississippi River Alluvial Plain. They also play a major role in the EGCP where they are predominantly associated with the Pearl, and Bogue Chitto River floodplains, with some additional areas along the Tangipahoa, Natalbany, Tickfaw and Amite Rivers (Smith 1999b). Bottomland hardwood forests are characterized and maintained by a natural hydrologic regime of alternating wet and dry periods generally following seasonal flooding events. These forests support distinct assemblages of plants and animals associated with particular landforms, hydric soils, and hydrologic regimes. They are important natural communities for maintenance of water quality, providing a very productive habitat for a variety of fish and wildlife species, and are important in regulating flooding and stream recharge. Bottomland hardwoods are extremely productive areas due in part to periodic flood-transported and deposited particulate and dissolved organic matter and nutrients (LNHP 1986-2004). In general, forested floodplain habitats are mixtures of broadleaf deciduous, needleleaf deciduous, and evergreen trees and shrubs. Bottomland hardwood forests contain a number of species which can be aggregated into specific associations or communities based on environmental factors such as physiography, topography, soils, and moisture regime (Allen 1997, The Nature Conservancy 2004). In the far eastern portion of the EGCP, along the lower Pearl River, several species associations are recognized with *Quercus laurifolia* (laurel oak) being the community dominant and *Persea borbonia* (red bay) being common in the understory (White 1983).

The following are three associations recognized by the LNHP in bottomland hardwood forests of Louisiana (LNHP1986-2004):

1). **Overcup Oak - Water Hickory Bottomland Forest**

Quercus lyrata (overcup oak) and *Carya aquatica* (water hickory) are codominants of this floodplain forest which occurs on low-lying poorly drained flats, sloughs in the lowest backwater basins, and on low ridges with clay soils that are subject to inundation. Semi-permanently inundated or saturated soils are generally present for major portion of the growing season. Associate species include *Fraxinus pennsylvanica* (green ash), *Celtis laevigata* (hackberry), *Cornus foemina* (swamp dogwood), *Forestiera acuminata* (swamp privet), *Planera aquatica* (planertree), *Cephalanthus occidentalis* (buttonbush) and vines. This community type has a long successional stage.

2). **Hackberry-American Elm-Green Ash Bottomland Forest**

Celtis laevigata (hackberry), *Ulmus americana* (American elm), and *Fraxinus pennsylvanica* (green ash) are codominants. This community occurs in floodplains of major rivers on low ridges, flats and sloughs in first bottoms. Soils are seasonally inundated or saturated periodically for 1 to 2 months during the growing season. Common associates are *Carya aquatica* (water hickory), *Quercus texana* (nuttall oak), *Q. phellos* (willow oak), *Q. nigra* (water oak), *Q. lyrata* (overcup oak), *Liquidambar styraciflua* (sweetgum), *Acer negundo* (box elder), *Ulmus alata* (winged elm), *Acer rubrum* (red maple), *Gleditsia aquatica* (water locust) and *Plantanus occidentalis* (American sycamore). Understory species include *Cornus foemina* (swamp dogwood), *Crataegus* spp. (hawthorn), and *Morus rubra* (red mulberry). Many vines and herbaceous plants are present.

3). **Sweetgum-Water Oak Bottomland Forest**

The community dominants are *Liquidambar styraciflua* (sweetgum) and *Quercus nigra* (water oak). Major associates are *Celtis laevigata* (hackberry), *Fraxinus pennsylvanica* (green ash), *Ulmus americana* (American elm), and *Q. texana* (Nuttall oak). It occurs in alluvial floodplains, extensively in the Mississippi alluvial valley on well drained first bottom ridges. Associated species are *Acer rubrum* (red maple), *Morus rubra* (red mulberry), *Smilax* spp. (greenbrier), *Sabal minor* (dwarf palmetto), *Ilex decidua* (deciduous holly), *Crataegus viridis* (green hawthorn), *Ampelopsis arborea* (peppervine), *Campsis radicans* (trumpet creeper), and *Toxicodendron radicans* (poison ivy). Soils are seasonally saturated or inundated for up to 2 months during the growing season.

Current Extent and Status:

Bottomland hardwood forest loss is estimated to be 50 to 75 % of the original presettlement acreage, statewide (Smith 1993). Old-growth examples of this habitat type are very rare. In the MRAP, clearing for agricultural production was the primary factor

that led to fragmentation and decline of this habitat type. Large tracts of bottomland hardwood forest remain but most are either second or third growth stands. This habitat can be found within many of the WMAs managed by LDWF and on NWRs managed by the USFWS. WMAs support 304,982 acres of bottomland hardwoods, while NWRs contain another 150,000 acres. The U.S. Army Corps of Engineers (COE) oversees the Atchafalaya Basin Floodway which is the largest remaining block of bottomland hardwood forests and swamp in the U.S. (595,000 acres) yet most of the basin remains in private ownership. Louisiana's ECGP still contains extensive areas of bottomland hardwood forest primarily along the Pearl and Bogue Chitto Rivers in St. Tammany and Washington Parishes, respectively. Much of this acreage is contained within the Bogue Chitto NWR, managed by the USFWS, and Pearl River WMA, operated by LDWF. The lower Tangipahoa and Natalbany Rivers in Tangipahoa Parish, as well as the Tickfaw and Amite Rivers in Livingston Parish, support tracts of bottomland forest (Smith 1999a, Smith 1999b). Louisiana State Parks including Chicot, Lake Fausse Point, Tickfaw, Fontainebleau, and Bogue Chitto support bottomland hardwood forests. Other small privately owned bottomland hardwood sites are located within all parishes in the state, and a total of 4,400 acres of combined bottomland hardwood forests and swamps are registered with the Louisiana Natural Areas Registry Program. Restoration efforts have been in progress since the 1980's, and with the aid of the Conservation Reserve Program (CRP) and Wetland Reserve Program (WRP) over 365,000 acres have been reforested in Louisiana (R. Marcantel, personal communication). Reconnecting fragmented forest blocks and restoration of wetland forest functions are the major challenges to reforestation efforts and are essential to providing adequate wildlife habitat in bottomland hardwood forest systems.

BOTTOMLAND HARDWOOD FOREST SPECIES OF CONSERVATION CONCERN (34)		
AMPHIBIANS	Yellow-throated Vireo	**MAMMALS**
Southern Dusky Salamander	Northern Parula	Southeastern Shrew
Louisiana Slimy Salamander	Prothonotary Warbler	Southeastern Myotis
Strecker's Chorus Frog	Swainson's Warbler	Louisiana Black Bear
Eastern Spadefoot	Louisiana Waterthrush	Long-tailed Weasel
Southern Crawfish Frog	Kentucky Warbler	Eastern Spotted Skunk
	Hooded Warbler	
BIRDS	Field Sparrow	**REPTILES**
Yellow-crowned Night-Heron	Rusty Blackbird	Alligator Snapping Turtle
Wood Stork	Orchard Oriole	Western Worm Snake
Swallow-tailed Kite		Common Rainbow Snake
Bald Eagle	**BUTTERFLIES**	Timber Rattlesnake
American Woodcock	Celia's Roadside Skipper	
Yellow-billed Cuckoo	Falcate Orangetip	
Wood Thrush	'Seminole' Texan Crescent	

Priority Species Research and Survey Needs:

Strecker's Chorus Frog: The current status of this species in Louisiana is uncertain, and it maybe extirpated. Intensive surveys are needed to update occurrence records and abundance for inclusion in LNHP database.

Swallow-tailed Kite: Continue to inventory and monitor Swallow-tailed Kites on public and private lands to fill data gaps in distribution and abundance for inclusion in the LNHP database and Audubon nationwide database. Begin research to determine the effects of silviculture/land management practices on this species.

Rusty Blackbird: Initiate surveys to determine wintering population abundances and habitat use to augment Christmas Bird Counts.

Songbirds: Continue to support research on silviculture/land management practices and their effects on all songbird species in this habitat.

Waterbirds: Continue to conduct rookery surveys to update the LNHP database information.

'Seminole' Texan Crescent: Conduct surveys to determine current distribution and abundance for inclusion in the LNHP database.

Louisiana Black Bear: Continue research on ecology and support repatriation efforts.

Eastern Spotted Skunk: Considered critically imperiled in Louisiana, intensive surveys are needed to update occurrence records and abundance for inclusion in LNHP database.

Southeastern Shrew: Considered imperiled in Louisiana. Together with Arkansas and Missouri, Louisiana represents the western edge of its range. Intensive surveys needed to update occurrence records and abundance for inclusion in LNHP database.

Species Conservation Strategies:

1. Swallow-tailed Kite: Implement conservation and management recommendations of SWG project T9 (Coulson 2004).
2. Bald Eagle: Continue long-term monitoring of active bald eagle nests, successful breeding pairs, and fledged eagles.
3. Louisiana Black Bear: Partner with the Black Bear Conservation Committee (BBCC), USFWS and continue to support the implementation of recovery efforts for this species.
4. American Woodcock: Develop partnerships with state and federal agencies, NGOs, and the private sector to implement the American Woodcock Management Plan.

5. Promote the use of appropriate silvicultural techniques to restore/manage Bottomland Hardwood (BLH) forests for wildlife (include importance of tree species diversity, den trees for birds and mammals, leaf litter, etc). Snags should be retained during logging operations for cavity-nesting wildlife species. Efforts need to be made to maintain sufficient levels of woody debris in stands for reptiles, amphibians and small mammals.
6. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.
7. Determine the microhabitat preferences and requirements of species utilizing bottomland hardwood forest to understand how these species are utilizing the habitat to determine management needs.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat								
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Herbivory	Modification of Water Levels; Changes in Natural Flow Patterns	Predation/ Parasitism/ Disease	Sedimentation	Toxins/ Contaminants
Channelization of rivers or streams	XXX	XXX				XXX			
Commercial/ industrial development		XXX		XXX					
Construction of ditches, drainage or diversion systems	XXX					XXX			
Conversion to agriculture or other forest types		XXX		XXX		XXX			
Crop production practices		XXX				XXX		XXX	XXX
Dam construction		XXX		XXX		XXX			
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX		XXX			
Incompatible forestry practices	XXX		XXX	XXX		XXX			
Invasive/alien species	XXX	XXX			XXX				
Oil or gas drilling		XXX	XXX	XXX					
Operation of dams or reservoirs	XXX					XXX			
Operation of drainage or diversion systems	XXX	XXX	XXX			XXX			
Parasites/pathogens	XXX						XXX		
Recreational use/vehicles			XXX						
Residential development		XXX	XXX	XXX		XXX			

Habitat Conservation Strategies:

1. Continue to monitor nuisance species (nutria, beaver, etc.) and control them as needed.
2. Promote use of appropriate silvicultural techniques to restore/manage BLH forests for wildlife (include importance of tree species diversity), den trees for birds and mammals, etc.
3. Encourage the use of BMP's in the conservation of this habitat type.
4. Work with NRCS and LFA to promote economic value of hardwood lumber to encourage the management/restoration of this habitat.
5. Support research regarding palmetto abundance in bottomlands and effects on wildlife species and habitat structure.
6. Work with adjoining states to address water management issues that affect bottomland hardwood habitat in Louisiana.
7. Work with BBCC, Louisiana Department of Transportation and Development (DOTD), NRCS, USFWS, U.S. Forest Service (USFS), private landowners, etc. to promote corridors of bottomland hardwood forests for wildlife species.
8. Work with oil and gas corporations to encourage the use of directional drilling to minimize the environmental impacts to this habitat.

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7. Brackish Marsh

Rarity Rank: S3S4/G4?
Synonyms: Needle Rush Marsh, Edge-Zone Marsh, Middle Estuary
Ecological Systems:
CES203.471 Mississippi Delta Salt and Brackish Tidal Marsh
CES203.468 Gulf Coast Chenier Plain Salt and Brackish Tidal Marsh

General Description:

Brackish marsh is usually found between salt marsh and intermediate marsh, although it may occasionally lie adjacent to the Gulf of Mexico. This community is irregularly tidally flooded and is dominated by salt-tolerant graminoids. Small pools or ponds may be scattered throughout.

Plant diversity and soil organic matter content are higher in brackish marsh than in salt marsh. Brackish marsh is typically dominated by *Spartina patens* (marshhay cordgrass). Other significant associated species include *Distichlis spicata* (salt grass), *Schoenoplectus olneyi* (three-cornered grass), *S. robustus* (salt marsh bulrush), *Eleocharis parvula* (dwarf spikesedge), *Ruppia maritima* (widgeon grass), *Paspalum vaginatum* (seashore paspalum), *Juncus roemanianus* (black rush), *Bacopa monnieri* (coastal water hyssop), *Spartina alteriflora* (smooth cordgrass), and *S. cynosuroides* (big cordgrass). Two other major autotrophic groups in brackish marsh are epiphytic algae and benthic algae. Generally speaking, vertebrate species population levels are higher in brackish marsh compared to Salt Marsh. Brackish marsh is of very high value to estuarine larval forms of marine organisms such as shrimp, crabs, menhadden, etc. (See Salt Marsh for other functions). Brackish marsh salinity averages about 8 ppt. This community may be changed to another marsh type by shifts in salinity. Intrusion of salt water from the Gulf of Mexico up numerous waterways exerts a major influence in the configuration of the various marsh types.

Current Extent and Status:

Presettlement extent of brackish marsh was estimated to have been between 500,000 and 1,000,000 acres with 50 to 75 percent remaining today (Smith 1993). At present the total acreage of brackish marsh appears to be increasing due to shifts in marsh salinity levels (LNHP 1986-2004). However, stable, viable examples of brackish marsh are rare in Louisiana.

There are a number of conservation areas in the Louisiana marsh managed by state and federal agencies and private organizations. The management of these sites is largely aimed at preserving and improving wintering waterfowl habitat. This involves the use of water control structures to regulate water

levels and salinity input, water/sediment diversions to abate marsh deterioration, and prescribed burning to improve habitat and food quality for wildlife. These management activities are necessary since levee construction and chanelization of waterways altered their hydrology and have cut many canals in the marsh for navigation and oil and gas exploration which serve as avenues for salt water intrusion. The Chenier plain will continue to deteriorate due to lack of sediment deposition by long shore currents which occurred historically when the Mississippi River shifted further west.

NWRs that support brackish marsh include Bayou Sauvage (approximately 9,000 acres are brackish), Delta (brackish acreage not known, about 60% of the 49,000 acre refuge is fresh marsh), and Sabine (total acreage ca 124,000, brackish marsh acreage unknown, approx. 33,000 acres are impounded fresh marsh). Of the areas managed by LDWF, Marsh Island and State Wildlife Refuges contain large areas of brackish marsh (70,000 acres and 13,000 acres, respectively). Biloxi WMA (40,000 total acres) supports mostly brackish marsh. Other refuges and WMAs containing brackish marsh, among other marsh types, include Pointe-aux-Chenes (total acres just over 31,000) and Rockefeller (total acres 76,000, intensely managed). Paul J. Rainey Sanctuary, owned by The Audubon Society, is 26,000 acres and consists largely of brackish marsh with a small area of intermediate marsh. Rainey Sanctuary is contiguous with LDWF's State Wildlife Refuge.

BRACKISH MARSH SPECIES OF CONSERVATION CONCERN (36)		
BIRDS	Clapper Rail	Loggerhead Shrike
Brown Pelican	King Rail	Seaside Sparrow
American Bittern	Whooping Crane	Nelson's Sharp-tailed Sparrow
Reddish Egret	Marbled Godwit	
Yellow-crowned Night-Heron	Dunlin	**BUTTERFLIES**
Mottled Duck	Short-billed Dowitcher	Neamathla Skipper
Northern Pintail	Gull-billed Tern	Palatka Skipper
Canvasback	Caspian Tern	Dion Skipper
Redhead	Royal Tern	Great Southern White
Lesser Scaup	Sandwich Tern	Western Pygmy-Blue
Bald Eagle	Common Tern	
Northern Harrier	Forster's Tern	**REPTILES**
Yellow Rail	Black Skimmer	Mississippi Diamondback Terrapin
Black Rail	Short-eared Owl	

Priority Species Research and Survey Needs:

Northern Harrier: Conduct surveys to determine its current distribution and winter abundance in coastal areas.

Yellow Rail and Black Rail: Determine current distribution and winter abundance in coastal areas.

Reddish Egret: Surveys needed to assess limiting factors on their reproductive success and the effects of human coastal recreational activities on bird populations.

Seaside Sparrow and Nelson's Sharp-tailed Sparrow: Conduct surveys to determine their current abundance and distribution in relation to changes in marsh composition. Large populations should be monitored on a yearly basis to detect long-term trends and to guide management decisions.

Waterbirds: Continue to conduct rookery surveys to update the LNHP database information.

Palatka Skipper, Great Southern White, Western Pygmy-Blue: Conduct surveys to determine current distribution and abundance for inclusion in the LNHP database.

Mississippi Diamondback Terrapin: Population status in Louisiana unknown; drastic declines apparent in other states, but perceived threats have not been proven. Review Marine Fisheries seine records and conduct replicate surveys to evaluate population trends.

Species Conservation Strategies:

1. Terns:
   - Disturbance and loss of nesting habitat are major threats; develop partnerships to strengthen the protection and restoration of barrier islands.
   - Develop a comprehensive survey methology to determine long term trends in population abundances.
2. Shorebirds, Wading Birds:
   - Provide public education regarding the importance of waterbird nesting colonies and shorebird feeding areas. Reduce the negative effects on these areas from recreational and other uses.
   - Work with landowners to implement management and conservation recommendations for waterbirds (especially rails) of SWG project T18 upon completion.
   - Coordinate with GCJV to implement recommendations of shorebird and wading bird conservation plans.
   - Disturbance and loss of nesting habitat are major threats. The continued protection and restoration of coastal marshes are top priorities. Develop new and/or improve existing partnerships to achieve this goal.
3. Waterfowl:
   - Continue to encourage the creation/enhancement/maintenance of high-quality habitat across Louisiana.
   - Work with Ducks Unlimited (DU), Delta Waterfowl (DW), and USFWS to assuring that quality habitat, including refuge from hunting and other disturbance, is distributed across the landscape.
   - Encourage the maintenance of rice farming north of marshes and discourage conversion to crops with lower value to waterfowl.
   - Continue LDWF partnerships with DU, DW, USWFS, and state wildlife management agencies to conserve habitat on the northern breeding grounds.

4. Brown Pelican: Continue with long-term monitoring of nesting colonies.
5. Bald Eagle: Continue with long-term monitoring of active bald eagle nests, successful breeding pairs, and fledged eagles.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat							
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Herbivory	Modification of Water Levels; Changes in Natural Flow Patterns	Salinity Alteration	Shoreline Erosion
Commercial/industrial development				XXX			XXX	
Construction of navigable waterways	XXX	XXX	XXX			XXX	XXX	XXX
Development/maintenance of pipelines, roads or utilities		XXX	XXX			XXX		
Fire suppression	XXX	XXX	XXX					
Grazing practices	XXX	XXX	XXX					
Invasive/alien species	XXX	XXX			XXX			
Levee or dike construction	XXX	XXX	XXX			XXX		XXX
Residential development		XXX	XXX					
Recreational use/vehicles								
Saltwater intrusion	XXX	XXX	XXX				XXX	XXX

Habitat Conservation Strategies:

1. Develop methods to encourage landowners to remove cattle from brackish marshes and manage the land for wildlife conservation.
2. Promote waterfowl management as an alternative to livestock production by providing incentives to landowners.
3. Support and encourage expansion of the mini-refuge system administered by USFWS refuges.
4. Work with LCA, CWPPRA to support coastal restoration projects, specifically targeting important waterbird nesting areas and species of conservation concern.
5. Work with COE and state agencies to insure water control structures provide the maximum benefit to brackish marsh.

6. Work with NRCS Plant Materials Center and BTNEP to develop viable cultivars for marsh restoration efforts.

References:

CHABRECK, R. H., AND G. LINSCOMBE. 1988. Louisiana coastal marsh vegetative type maps. Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

LNHP. 1986-2004. The natural communities of Louisiana. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

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8. Calcareous Forest

Rarity Rank: S2/G2?Q
Synonyms: Calcareous Hardwood Forest, Dry Calcareous Woodland, Blackland Hardwood Forest, Upland Hardwood Forest, Circum-Neutral Forest
Ecological Systems:
CES203.379 West Gulf Coastal Plain Southern Calcareous Prairie
CES203.378 West Gulf Coastal Plain Pine-Hardwood Forest

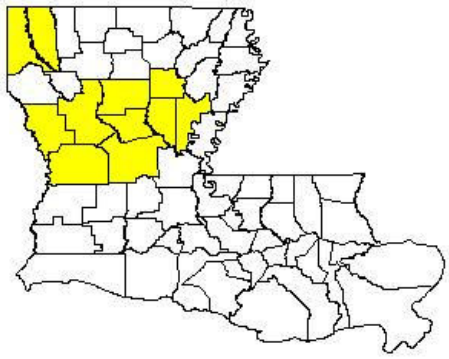
General Description:

This community occurs on calcareous substrata in the uplands of central, western and northwest Louisiana. It characteristically occurs on hills and slopes on either side of small creeks, at times in a mosaic with calcareous prairies. Associated geological formations so far identified are the same as for calcareous prairie. Soils are stiff calcareous clays, not quite as alkaline as in the prairies (surface pH ~ 6.5-7.5), with very high shrink-swell characteristics. Individual occurrences are usually of limited areal extent.

Common overstory species include *Quercus stellata* (post oak, often dominant), *Q. shumardii* (shumard oak), *Q. alba* (white oak), *Q. muhlenbergii* (chinkapin oak), *Carya myristiciformis* (nutmeg hickory), *C. ovata* (shagbark hickory), *C. tomentosa* (mockernut hickory), *Pinus echinata* (shortleaf pine), *P. taeda* (loblolly pine), *Fraxinus americana* (white ash), *Diospyros virginiana* (persimmon), *Liquidambar styraciflua* (sweetgum), *Celtis* spp. (hackberries), *Gleditsia triacanthos* (honey locust), *Morus rubra* (red mulberry), *Fagus grandifolia* (beech), *Ulmus rubra* (slippery elm), *U. americana* (American elm), *U. alata* (winged elm), *U. crassifolia* (rock elm), and *Acer rubrum* (red maple). *Quercus sinuata* var. *sinuata* (Durand oak) and *Q. oglethorpensis* (Oglethorp oak) may rarely be present. Trees, especially pines, are often stunted and/or crooked due to extreme physical soil properties. Midstory and understory shrubs typically include *Viburnum rufidulum* (rusty blackhaw), *Crataegus* spp. (hawthorns), *Prunus mexicana* (Mexican plum), *Cercis canadensis* (red bud), *Chionanthus virginicus* (fringe-tree), *Asimina triloba* (paw-paw), *Ilex decidua* (deciduous holly), *Vaccinium arboreum* (winter huckleberry), *Rhamnus caroliniana* (Indian cherry), *Rhus copallina* (flame-leaf sumac), *Ostrya virginica* (hop-hornbeam), and *Aesculus pavia* (red buckeye). *Maclura pomifera* (osage-orange) may occur sporadically, especially in northwest Louisiana. The herbaceous layer may contain *Symphyotrichum drummondii* (Drummond's aster), *Solidago auriculata* (auricled goldenrod), *Cynoglossum virginianum* (hound's-tounge), *Antennaria plantaginifolia*

(plantain-leaf pussy-toes), *Lithospermum tuberosum* (tuberous puccoon), *Pedicularis canadensis* (Canadian lousewort), *Podophyllum peltatum* (may-apple), *Phlox divaricata* (phlox), *Elephantopus* spp. (elephant-foot), *Viola* spp. (violets), *Chasmanthium* spp. (spangle-grasses), *Bromus* spp. (brome grasses), *Onosmodium hispidissimum* (false-gromwell), *Sanicula canadensis* (snakeroot), *Zizia aurea* (golden alexanders), *Tipularia discolor* (crane-fly orchid), *Agrimonia* spp. (agrimony), *Galium* spp. (bedstraws), and others. Fire is thought to have played a minor role in the dynamics of this community.

Current Extent and Status:



Additional field survey work is needed to more accurately determine the status and extent of calcareous forests. It is estimated that 50,000 to 100,000 acres of this habitat occurred in presettlement times and that 25 to 50 percent remain today (Smith 1993). Confirmed occurrences in the LNHP database are from Bossier, Caldwell, Grant, and Winn Parishes. Calcareous forests certainly occur (or did occur) in the remaining parishes in the distribution map. There are several high quality occurences on conservation areas such as KNF (particularly the Winn Ranger District), Barksdale Air Force Base, Bodcau WMA, and TNC's Copenhagen Hills Preserve.

CALCAREOUS FOREST SPECIES OF CONSERVATION CONCERN (7)	
BIRDS	**MAMMALS**
American Woodcock	Long-tailed Weasel
Yellow-billed Cuckoo	Eastern Spotted Skunk
Wood Thrush	
Orchard Oriole	**REPTILES**
	Southeastern Scarlet Snake

Priority Species Research and Survey Needs:

Birds: Work with state Breeding Bird Survey (BBS) coordinator to ensure that survey routes are conducted in this habitat where feasible.

Species Conservation Strategies:

1. Wood Thrush: Develop a monitoring program (i.e., Monitoring Avian Productivity and Survival (MAPS)) to assess relative abundance in this habitat.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat		
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance
Conversion to agriculture or other forest types		XXX	
Fire suppression	XXX		
Incompatible forestry practices	XXX		XXX
Invasive/alien species	XXX		
Recreational use/vehicles			XXX

Habitat Conservation Strategies:

1. Conduct surveys to determine the current extent and condition of this habitat type.
2. Develop management plans/recommendations for this habitat type.
3. Promote fire as essential management tool; promote alternatives where prescribed burning is not an option.
4. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamplets and the LDWF website.
5. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
6. Support research to understand the basic ecosystem characteristics and processes of this habitat type.

References:

HART, B. L., AND G. D. LESTER. 1993. Natural Community and sensitive species assessment on Ft. Polk Military Reservation, Louisiana. Louisiana Department of Wildlife and Fisheries in cooperation with The Nature Conservancy, Submitted to Army Corps of Engineers.

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MCINNIS, N. C. 1997. Barksdale Air Force Base - threatened and endangered species - natural areas survey. The Nature Conservancy, Louisiana Field Office, Baton Rouge, LA.

SMITH, L. M., N. M. GILMORE, R. P. MARTIN, AND G. D. LESTER. 1989. Keiffer calcareous prairie/forest complex: A research report and preliminary management plan. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

———.1993. Estimated presettlement and current acres of natural plant communities in Louisiana. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

9. Calcareous Prairie

Rarity Rank: S1/G1
Synonyms: Barrens, Calcareous Barrens, Calcareous Clay Prairie, Keiffer Prairie, Jackson Prairie, Blackland Prairie, Calcareous Glade
Ecological Systems: CES203.379 West Gulf Coastal Plain Southern Calcareous Prairie

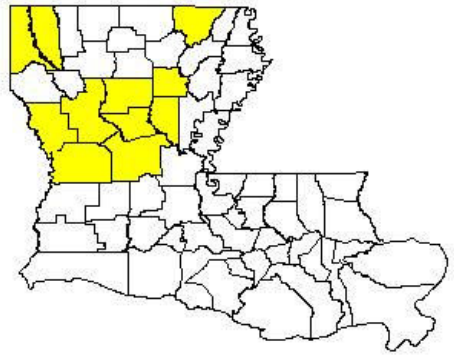
***General Description*:**

Calcareous prairies are typically small, naturally treeless areas occurring on calcareous substrata in the uplands of central, western, and northwest Louisiana. They range in size from less than one acre, up to 80 or more acres, and occur in a mosaic with calcareous forests. Calcareous prairies have been identified in association with four geological formations: Intermediate Terraces (Pleistocene) associated with old Red River deposits in northwest Louisiana (**Morse Clay Prairies**), the **Fleming Formation** (Tertiary-Miocene) in central-western Louisiana, the **Jackson Group** (Tertiary-Eocene) in central Louisiana, and the **Cook Mountain Formation** (Tertiary-Eocene) in central and western Louisiana. Soils are stiff calcareous clays (surface pH ~ 7.5-8.0), with very high shrink-swell characteristics, and range in color from red to olive-tan to gray-black. Various soil inclusions occur (depending on geology) and may include calcareous concretions (limestone nodules), marine mollusc shells, shark teeth, and gypsum crystals.

The herbaceous flora is very diverse and dominated by grasses, composites, and legumes. Common grass species are *Schizachyrium scoparium* (little bluestem), *Sporobolus* spp. (dropseeds), *Andropogon glomeratus* (bushy broomsedge), *Andropogon gerardii* (big bluestem), *Sorghastrum nutans* (Indian grass), *Aristida* spp. (three-awn grasses), *Paspalum* spp. (paspy grasses), *Panicum* spp. (panic grasses), *Eragrostis* spp. (love grasses), and *Setaria* spp. (bristle grasses). A number of exotic grass species may occur. Common composites include *Eurybia* spp. and *Symphyotrichum* spp. (asters), *Liatris* spp. (blazing-stars), *Coreopsis* spp. (tick-seeds), *Solidago* spp. (goldenrods), *Ambrosia psilostachya* (western ragweed), *Vernonia* spp. (ironweeds), *Rudbeckia* spp. (brown-eyed susans), *Eupatorium* spp. (thoroughworts), *Echinacea pallida* (pale coneflower), *E. purpurea* (purple coneflower), *Silphium* spp. (rosin-weeds), *Cacalia plantaginea* (Indian plantain), *Gaillardia aestivalis* (blanket flower), and *Helenium* spp. (sneeze-weeds). Frequently encountered legumes include *Acacia angustissima* (prairie acacia), *Baptisia* spp. (indigos), *Desmanthus illinoensis* (wad o'pods), *Galactia volubilis* (milk pea), *Mimosa strigillosa* (sensitive-plant), *Neptunia lutea* (yellow puff), *Petalostemum candidum* (white prairie-clover), and *P. purpureum* (purple prairie-clover).

Additional forbs of prominence are *Anemone berlandieri* (wind flower), *Ranunculus* spp. (crow-foot), *Asclepias* spp. (milk-weeds), *Callirhoe papaver* (poppy-mallow), *Delphinium carolinianum* (larkspur), *Hedyotis nigricans* (bluets), *Hedyotis purpurea* var. *calycosa* (prairie bluets), *Linum* spp. (flax), *Oenothera speciosa* (Mexican evening-primrose), *Ruellia humilis* (wild petunia), and *Salvia azurea* (blue sage). Calciphilic woody species that are often present (and that may come to dominate unburned prairies) include *Crataegus* spp. (hawthorns, often most prominent), *Bumelia lanuginosa* (chittum-wood), *Berchemia scandens* (rattan-vine), *Diospyros virginiana* (persimmon), *Cornus drummondii* (rough-leaf dogwood), *Juniperus virginiana* (eastern red cedar), *Ilex decidua* (deciduous holly), *Smilax bona-nox* (greenbrier), *Fraxinus americana* (white ash), and *Gleditsia triacanthos* (honeylocust). *Maclura pomifera* (osage-orange) may sporadically occur on edges, especially in northwestern Louisiana. Regularly-occurring fire, high soil pH, and extreme physical soil properties are postulated to have acted in concert to generate and perpetuate these upland clay prairies.

Current Extent and Status:



Historically there was an estimated 2,000 to 10,000 acres of calcareous prairie statewide and five to 10 percent of the original extent is thought to remain today (Smith 1993). Currently there are a handlful of protected calcareous prairies on each formation.

Calcareous prairies found on the Jackson formation are concentrated near Copenhagen in Caldwell Parish. Many of these are captured by TNC's Copenhagen Hills Preserve. There is one known occurrence of this type on the Catahoula Ranger District of KNF in Grant Parish. There is a high concentration of Cook Mountain calcareous prairies on the Winn Ranger District of KNF near Calvin in Winn Parish. Recently, the USFS has been working to remove invading woody vegetation and expand these prairies openings to their former extent. There are a few prairies just off of KNF on private land that have an opportunity to be protected and managed for the benefit of this habitat type. A narrow finger of the Cook Mountain Formation extends southwest into Sabine Parish and supports one known calcareous prairie near Florien that is degraded but recoverable. There are surely more prairies along this portion of the Cook Mountain Formation. Fleming Calcareous Prairies are scattered in Vernon, Rapides, and Natchitoches Parishes. Several occurrences are on Ft. Polk and KNF. Most are on private land and are likely degraded. Given the inclusional nature of this habitat, they are frequently site prepared and planted in loblolly pine plantations despite their poor capacity to grow timber. Survey work is needed to determine the condition of calcareous prairies on private land.

There are about 15 known Morse Clay prairies in Bossier and Caddo parishes, several of which are found on public land. Several are captured by Bodcau WMA, which is owned by COE and leased by LDWF. Some of the prairie acreage on Bodcau WMA is

protected in registered natural areas but much (probably >50%) of the acreage that was historically Morse Clay prairie on Bodcau WMA is now managed for food plots. There is an excellent opportunity to attempt to restore this habitat on Bodcau WMA.

There are several Morse Clay calcareous prairies known to occur on Barksdale Air Force Base. Most of these prairies, particularly the ones within Escarpment Natural Area, are of high quality (McInnis 1997). The Barksdale prairies are important intrinsically, but they also present a standard by which the quality of other prairies may be evaluated. This is especially important in monitoring the results of restoration projects. The status of the Morse Clay prairies on private land is unknown. Only one such prairie has been visited in the last 10 to 12 years. The prairie was still viable but contained large-diameter *Juniperus virginiana* (eastern redcedar).

CALCAREOUS PRAIRIES SPECIES OF CONSERVATION CONCERN (12)		
BIRDS	**BUTTERFLIES**	**MAMMALS**
Northern Bobwhite	Dusted Skipper	Hispid Pocket Mouse
American Woodcock	Reakirt's Blue	Eastern Harvest Mouse
Loggerhead Shrike	Little Metalmark	
Field Sparrow	Southern Dogface	**REPTILES**
Grasshopper Sparrow		Western Slender Glass Lizard

Priority Species Research and Survey Needs:

Loggerhead Shrike: BBS data for the period 1966-2000 indicate a 71% population decline rangewide. Monitoring of reproductive success and the effects of pesticides on food availability are needed along with statewide evaluation of changes in available habitat.

Birds: Work with state BBS coordinator to ensure that BBS routes are conducted in this habitat where feasible.

Hispid Pocket Mouse: Considered imperiled in Louisiana, intensive surveys needed to update occurrence records and abundance for inclusion in the LNHP database.

Eastern Harvest Mouse: Considered vulnerable in Louisiana, intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Western Slender Glass Lizard: Exhibiting rangewide population declines; their status in Louisiana is not well known. Work cooperatively with forestry agencies, forestry companies and field biologists to collect observation data.

Species Conservation Strategies:

1. Northern Bobwhite and Grassland Birds: Support the implementation of recommended habitat restoration actions specified in NBCI and by LDWF Quail and Grassland Bird Task Force.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat			
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Soil Erosion
Conversion to agriculture or other forest types	XXX	XXX		
Incompatible forestry practices	XXX		XXX	XXX
Invasive/alien species	XXX		XXX	XXX
Log deck debris			XXX	
Management of/for certain species	XXX		XXX	
Oil or gas drilling		XXX	XXX	
Recreational use/vehicles			XXX	XXX
Residential development		XXX	XXX	

Habitat Conservation Strategies:

1. Conduct status surveys to determine the extent and condition of this habitat type (Morse clay prairie, all types).
2. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots within this habitat type.
3. Encourage the reporting of occurrences of this habitat type (target foresters).
4. Investigate funding opportunities for prairie restoration and the development of plant materials for prairie restoration.
5. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamplets and the LDWF website.
6. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
7. Support research to determine the effectiveness of restoration efforts of this habitat.

References:

LNHP. 1986-2004. The natural communities of Louisiana. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

MARTIN, D. L., AND L. M. SMITH. 1991. A survey and description of the natural plant communities of the Kisatchie National Forest, Winn and Kisatchie Districts. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

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NATURESERVE. 2005. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.2. NatureServe, Arlington, Virginia. http://www.natureserve.org/explorer. (Accessed: March 8, 2005).

SMITH, L. M., N. M. GILMORE, R. P. MARTIN, AND G. D. LESTER. 1989. Keiffer calcareous prairie/forest complex: A research report and preliminary management plan. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

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10. Coastal Dune Grassland/Shrub Thicket

Rarity Rank: S1S2/G2G3
Synonyms: Maritime Grassland, Dune Meadow, Dune Grass
Ecological Systems:
CES203.469 Louisiana Beach
CES203.471 Southeastern Coastal Plain Interdunal Wetland
CES203.544 Upper Texas Coast Beach

General Description:

(Note: Coastal Dune Grasslands and Coastal Dune Shrub Thickets are described as distinct communities in the LNHP Natural Communities of Louisiana. They are considered together here due to their floristic similarity and similarity in management needs.)

Coastal Dune Grassland occurs on beach dunes and relatively elevated backshore areas (ridges) above intertidal beaches on barrier islands and on the mainland. The dunes of Louisiana's barrier islands and mainland beaches are poorly developed because of the high frequency of overwash associated with hurricanes and storms, and a limited amount of eolian-transported sand. The sites are normally xeric (excessively drained) owing to the fact that they are elevated above the highest flood mark (except during hurricanes). These sites are exposed to moderate to high amounts of salt spray. In addition, limited nutrient availability and substrate instability also affect coastal dune vegetation.

The vegetative cover ranges from sparse to fairly dense and is dominated by salt spray tolerant grasses, which may include *Spartina patens* (wiregrass, usually present and often dominant), *Uniola paniculata* (sea oats), *Panicum amarum* (beach panic), *Triplasis purpurea* (purple sandgrass), *Paspalum vaginatum* (jointgrass), *Schizachyrium maritimum* (seacoast bluestem), *Distichlis spicata* (saltgrass), *Cenchrus* spp (sandburs), *Chloris petraea* (finger grass), *Sporobolus virginicus* (coast dropseed), *Eragrostis oxylepis* (red lovegrass), and *Andropogon* spp. (broomsedges). Forbs are common in this community and may form forb-dominated zones, particularly on the gulfward side of the dune. Forbs include *Batis maritima* (salt wort), *Ipomea stolonifera* (beach morning-glory), *I. pes-caprae* (goat-foot morning-glory), *Heliotropium currasivicum* (seaside heliotrope), *Strophostyles helvola* (sand wild bean), *Agalinis maritima* (seaside false foxglove), *Iva imbricata* (sumpweed), *Solidago sempervirens* (seaside goldenrod), *Cakile* spp. (sea rockets), *Croton punctatus* (punctate goatweed), *Hydrocotyle bonariensis* (large leaf pennywort), *Heterotheca subaxillaris* (camphor weed), *Sesuvium portulacastrum* (sea purselane), *Pluchea camphorata* (camphor-weed), *Sabatia stellaris* (seastar rose-gentian), *Atriplex arenaria* (quelite), *Aphanostephus skirrobasis* (lazy daisy), *Salicornia*

spp. (glassworts), *Sueda linearis* (annual seepweed), *Centrosema virginianum* (butterfly pea) and *Lippia nodiflora* (common frog-fruit). Shrubs from adjacent Coastal Dune Shrub Thickets may occur as scattered individuals in this community. These sites are subject to frequent storm overwash with salt water flooding and sand deposition. These events frequently give rise to what are called "barrier flats". Dune swales may be extensive and are considered as inclusions in this natural community. Dunes and ridges may be shifted or eroded by storm floods, destroying vegetation.

If dunes remain stable, allowing natural succession to progress, then **Coastal Dune Shrub Thickets** are formed. These occur on established sand dunes and beach ridges on barrier islands and the mainland coast. Coastal dune shrub thickets are of very limited extent in Louisiana due to relatively poorly developed coastal dunes. The sites are typically xeric to xeric/mesic and moderately exposed to salt spray. This community normally appears as a relatively dense stand of shrubs. A variety of salt-tolerant shrubs may occur including *Morella cerifera* (wax myrtle), *Ilex vomitoria* (yaupon), *Iva* spp. (marsh elder), *Baccharis halimifolia* (saltbush), *Acacia smallii* (acacia), and *Zanthoxyllum clava-herculis* (toothache tree). The shrubs are often covered with a dense growth of lichens. Vines, such as *Smilax* spp. (greenbriers) and *Vitis mustangensis* (wild grape), are often present. This community may be destroyed by sand dune migration or erosion and may be replaced by Coastal Dune Grassland.

Current Extent and Status:

Coastal dune grassland and shrub thickets are estimated to have occupied less than 2,000 acres each in presettlement times and for both communties, 50 to 75% is thought to remain today (Smith 1993). The most extensive examples of coastal dune grasslands are on the Chandeleur Islands, Timablier Islands, Isle Dernieres, and on the Chenier Plain from about Rutherford Beach (east of Cameron) westward to near the Texas state line. This habitat also occurs along other barrier islands and shorelines subject to high wave energy. The Chandeleur Islands are part of Breton NWR. Five islands in the Isle Dernieres chain (Wine, Whiskey, East, Trinity, and Raccoon) comprise LDWF's Isle Dernieres Barrier Islands Refuge.

Grand Isle supports some extensive coastal dune shrub thickets specifically on the east and west ends of the island. A considerable portion of this habitat is captured by Grand Isle State Park. None of the Cameron Parish coastal dune grassland/shrub thicket habitat falls within a conservation area.

COASTAL DUNE – GRASSLAND SHRUB THICKET SPECIES OF CONSERVATION CONCERN (11)		
BIRDS	Grasshopper Sparrow	**MAMMALS**
Brown Pelican		Eastern Spotted Skunk
Northern Harrier	**BUTTERFLIES**	
Wilson's Plover	Wild Indigo Duskywing	**REPTILES**
Short-eared Owl	Great Southern White	Western Slender Glass Lizard
Loggerhead Shrike		Eastern Glass Lizard

Priority Species Research and Survey Needs:

Northern Harrier: Conduct surveys to determine their current distribution and winter abundance in coastal areas.

Wild Indigo Duskywing and Great Southern White: Conduct surveys to determine their current distribution and abundance for inclusion in LNHP database.

Eastern Glass Lizard: This species has not been observed outside of the Grand Isle population in nearly thirty years, despite adequate habitat. Conduct surveys to determine if Grand Isle population is extant.

Species Conservation Strategies:

1. Brown Pelican: Continue with long-term monitoring of nesting colonies.
2. Waterbirds and Shorebirds: Work with LCA, CWPPRA to incorporate strategies specifically targeting important waterbird and shorebird nesting areas in all future coastal restoration efforts.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat			
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX
Fire suppression	XXX			
Grazing practices	XXX		XXX	
Invasive/alien species	XXX			
Recreational use/vehicles	XXX		XXX	
Residential development		XXX	XXX	XXX
Shoreline erosion		XXX		XXX

Habitat Conservation Strategies:

1. Partner with NGOs, private landowners, etc. to promote protection of coastal dune grasslands and shrub thickets and continue to encourage landowners to enroll this habitat type in the Natural Areas Registry Program.
2. Promote education about invasive plant species within this habitat and methods to eradicate or control invasives.
3. Support NRCS and LDNR efforts for shoreline stabilization and habitat restoration.
4. Work with local governments to recommend limits on recreational vehicle use of this habitat.
5. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.
6. Work with NRCS Plant Materials Center and BTNEP to develop viable cultivars for coastal dune restoration efforts.
7. Work with the legislature to develop tax incentives and conservation easements or leases for landowners to encourage conservation of this habitat type.

References:

LNHP. 1986-2004. The natural communities of Louisiana. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

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11. Coastal Live Oak-Hackberry Forest

Rarity Rank: S1S2/G2
Synonyms: Cheniere, Maritime Forest, Chenier Maritime Forest
Ecological Systems: CES203.466 West Gulf Coastal Plain Chenier and Upper Texas Coastal Fringe Forest and Woodland

General Description:

Coastal Live Oak-Hackberry Forest or Cheniere (French for "place of oaks") is the natural community which formed on abandoned beach ridges primarily in southwest Louisiana. These ancient beaches were stranded via deltaic sedimentation by the constantly shifting Mississippi River. Composed primarily of fine sandy loams with sand and shell layers or deposits, these ridges are mostly 4 to 5 feet above sea level. *Quercus virginiana* (live oak) and *Celtis laevigata* (hackberry) are the dominant canopy species. Other characteristic species are *Gleditsia triacanthos* (honeylocust), *Acer rubrum* var. *drummondii* (swamp red maple), *Zanthoxylum clava-herculis* (toothache tree), *Quercus nigra* (water oak), *Fraxinus pennsylvanica* (green ash), and *Ulmus americana* (American elm). Subcanopy species include *Crataegus viridis* (green hawthorn), *Dispyros virginiana* (persimmon), and *Ilex decidua* (deciduous holly). *Sabal minor* (palmetto) and *Opuntia* spp. (prickly pear cactus) are also common in the understory (LNHP 1986-2004, NatureServe 2005, Neyland and Meyer 1997). *Triadica sebifera* (=*Sapium sebiferum*; Chinese tallowtree) has become a serious invader of chenier forests, and can have major impacts on community structure and composition (Neyland and Meyer 1997). The chenieres are important storm barriers limiting saltwater intrusion into marshes. Typically, marshes north of chenieres are fresher than those gulfward. This community also functions as important wildlife habitat and serves as vital resting habitat for trans-gulf-migrating birds (Mueller 1990). Hundreds of thousands of birds (hundreds of different species) use chenieres as a stop-over point during migration.

Current Extent and Status:

Louisiana's coastal chenier forests occur in the Chenier Plain from Iberia Parish westward across Vermilion and Cameron parishes. Since this forest type is found only on remnant beach ridges which are higher and drier than the surrounding marshes, they were the first areas to be cleared and developed. Of the original 100,000 to 500,000 acres in Louisiana, only 2,000 to 10,000 acres remain, 2-10 % of presettlement extent. The majority of these remnant forests are altered and fragmented, and threats continue from residential development, roads and utility construction, and overgrazing. Currently there

are few cheniers supporting high-quality examples of this natural community, and very few are afforded any degree of protection. The Audubon Society maintains the 40 acre Peveto Woods Bird and Butterfly Sanctuary in Cameron Parish, and one 146 acre tract owned by the Vermilion Parish School Board is registered with the Louisiana Natural Areas Registry Program.

Importance to Neotropical Migrant Songbirds:

It must be noted that the chenier plain-coastal live oak-hackberry forest habitat is extremely important as stopover sites for neotropical songbirds during spring and fall migration. The majority of migrants fly nonstop for more than 1,000 kilometers to cross the Gulf of Mexico each spring. At least 82 species of migratory birds regularly use these wooded habitats to replenish energy reserves necessary to successfully complete their migration immediately after crossing the Gulf of Mexico. During fall migration these chenier plain habitats provide important habitat corridors and staging areas as birds move along the coast through Texas and around the Gulf of Mexico on their journey to Central and South America.

COASTAL LIVE OAK - HACKBERRY FOREST SPECIES OF CONSERVATION CONCERN (13)		
BIRDS	**BUTTERFLIES**	**REPTILES**
American Woodcock	Celia's Roadside Skipper	Ornate Box Turtle
Yellow-billed Cuckoo	Falcate Orangetip	Western Slender Glass Lizard
Northern Parula		Timber Rattlesnake
Prothonotary Warbler	**MAMMALS**	
Painted Bunting	Southeastern Myotis	
Field Sparrow		
Orchard Oriole		

Priority Species Research and Survey Needs:

Celia's Roadside Skipper, Falcate Orangetip: Conduct surveys to determine their current distribution and abundance for inclusion in the LNHP database.

Ornate Box Turtle: Initiate surveys in areas identified by SWG project T20 (Lorenz and Hemmerling 2004) to update occurrence and abundance data for inclusion in the LNHP database.

Neotropical Migrant Birds: Continue to monitor neotropical bird use of chenier habitats.

Species Conservation Strategies:

1. Promote the benefits of bat colonies and roost sites and develop partnerships with landowners to encourage protection of valauable sites.

2. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS endangered and threatened species recovery plans over the next 10 years.
3. Determine the microhabitat preferences and requirements of species utilizing Coastal Live Oak-Hackberry Forest to understand how these species are utilizing the habitat and to determine management needs.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat			
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Development/maintenance of pipelines, roads or utilities				XXX
Grazing practices	XXX		XXX	
Invasive/alien species	XXX			
Mining practices		XXX		
Residential development		XXX	XXX	XXX
Shoreline erosion		XXX		

Habitat Conservation Strategies:

1. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
2. Partner with state and federal agencies, NGOs, private landowners, etc. to increase conservation efforts of cheniers.
3. Work with COE and NRCS to develop better strategies for the placement of dredge materials as a restoration method for this habitat type.
4. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamplets and the LDWF website.
5. Review Texas tax exemption policies regarding livestock. Determine which of these policies may apply to conservation of cheniers in Louisiana, and work with the legislature to incorporate these policies into the tax code.
6. Support NRCS and LDNR efforts for shoreline stabilization and habitat restoration.
7. Support public acquisition/protection of high quality cheniers that have the potential for longterm sustainability.

8. Develop methods to encourage landowners to remove cattle from cheniers and manage the land for wildlife conservation.
9. Work with LCA, CWPPRA to broaden the coastal restoration projects to include cheniers.
10. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.
11. Provide information to landowners about incentive programs/cost share opportunities to control invasives.

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12. Coastal Mangrove-Marsh Shrubland

Rarity Rank: S3/G2?
Synonyms: Intertidal Saltwater Swamp, Saltwater Swamp, Mangrove Swamp
Ecological Systems: CES203.471 Mississippi Delta Salt and Brackish Tidal Marsh

General Description:

Coastal Mangrove/Marsh Shrubland are estuarine communities dominated by *Avicennia germinans* (black mangrove). Although sometimes termed a swamp, the physiognomy of the community in Louisiana more closely resembles a shrub thicket. The coastal region of Louisiana delimits the northern range of this community due to mangrove's inability to tolerate temperatures below freezing. The top-kill caused by winter freezes also limits mangroves to a shrub-like form (10 feet or less in height), unlike Florida where they attain forest stature. Other characteristic vegetation associates include: *Spartina alterniflora* (smooth cordgrass), *Batis maritima* (saltwort), *Salicornia virginica* (creeping glasswort), *Iva frutescens* (marshelder), *Borrichia frutescens* (sea ox-eye), and *Distichlis spicata* (salt grass). Mixed stands of both species are comparatively frequent in Louisiana. Salt marshes and mangrove habitats are integral parts of the Louisiana barrier island system. The mangrove shrubland has several important ecological functions: the extensive root systems stabilize the shoreline and reduce erosion; the cover and food they provide create an excellent nursery area for fish and shellfish; the community improves surrounding water quality by filtering nutrients and suspended sediments; and many colonial waterbirds use the mangrove swamp for nesting.

Current Extent and Status:

Mangroves in Louisiana are found along the fringes of the Deltaic Plain coastal marshes most commonly flanking large bays and on the leeward side of barrier islands. Montz (1980) estimated that in the late 1970's a total of 3,900 to 5,900 acres of mangroves occurred in Louisiana. Hard freezes in the winters of 1983 and 1984 seriously reduced the extent of this community in coastal Louisiana. The mangrove swamps importance in erosion control was clearly

documented by the extreme erosion of Queen Bess Island following the 1983-84 dieback, and today mangrove is often used for marsh stabilization in coastal restoration projects. Mild winters of the past decade have allowed expansion of this natural community in southeastern Louisiana's coastal marshes. Large expanses can be viewed near the southern terminus of LA Hwy 1 on the eastside of Timbalier Bay near Port Fourchon, with patchy occurrences continuing along the highway to Grand Isle.

COASTAL MANGROVE – MARSH SHRUBLAND SPECIES OF CONSERVATION CONCERN (8)	
BIRDS	**BUTTERFLIES**
Brown Pelican	Great Southern White
Reddish Egret	Western Pygmy-Blue
Yellow-crowned Night-Heron	
Clapper Rail	
Seaside Sparrow	
Nelson's Sharp-tailed Sparrow	

Priority Species Research and Survey Needs:

Seaside Sparrow and Nelson's Sharp-tailed Sparrow: Surveys are needed to determine the current abundance and distribution in relation to marsh changes. Large populations should be monitored on a scheduled basis to detect long-term population trends and to guide management decisions.

Brown Pelicans: Large populations should be monitored on a scheduled basis to detect long-term population trends and to guide management decisions.

Waterbirds: Continue to conduct rookery surveys to update the LNHP database.

Great Southern White and Western Pygmy-Blue: Conduct surveys to determine their current distribution and abundance for inclusion in the LNHP database.

Species Conservation Strategies:

1. Shorebirds, Wading Birds:
   - Provide public education regarding the importance of waterbird nesting colonies and shorebird feeding areas. Reduce the negative effects of recreational and other uses on these areas.
   - Implement management and conservation recommendations for waterbirds (especially rails) of SWG project T18 upon completion.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat		
Source of Threat	Altered Composition/ Structure	Habitat Disturbance	Habitat Fragmentation
Invasive/alien species	XXX		
Recreational use/vehicles		XXX	
Shoreline erosion	XXX		XXX

Habitat Conservation Strategies:

1. Work with the legislature to develop tax incentives and conservation easements or leases for landowners to encourage conservation of this habitat type.
2. Promote the planting of mangrove as a soil stabilizer in habitat restoration projects.
3. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamplets and the LDWF website.
4. Support NRCS and LDNR efforts for shoreline stabilization and habitat restoration.
5. Work with LCA, CWPPRA to support coastal restoration projects, specifically targeting important nesting habitat for species of conservation concern.
6. Work with local governments to recommend limits on recreational vehicle use of this habitat, particuarly where it occurs on barrier islands.
7. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.
8. Work with NRCS Plant Materials Center, BTNEP,and OSP to develop restoration program for this habitat.

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13. Coastal Prairie

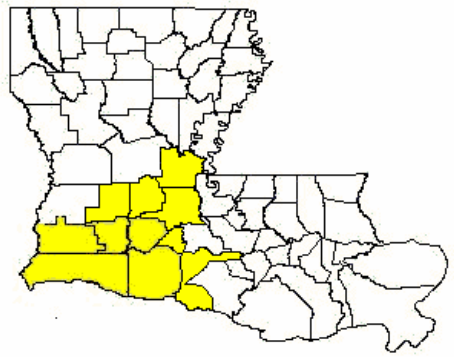
Rarity Rank: S1/G2Q
Synonyms: Great Southwest Prairie, Eastern Coastal Prairie, Gulf Cordgrass Prairie, Cajun Prairie
Ecological Systems:
CES203.550 Texas-Louisiana Coastal Prairie
CES203.541 Texas-Louisiana Coastal Prairie Pondshore
CES203.543 Texas-Louisiana Saline Coastal Prairie
CES203.542 West Gulf Coastal Plain Texas-Louisiana Coastal Prairie Slough

General Description:

The prairie region of southwestern Louisiana was once very extensive (approximately 2.5 million acres), but today is limited to small, remnant parcels. On the south edge of its range, the community may occur on "islands" or "ridges" surrounded by marsh. The region is underlain by an impervious clay pan 6 to 18 inches below the surface that prevents downward percolation of water and inhibits upward movement of capillary water. Soils are typically circum-neutral to alkaline, saturated in winter, and often very dry in late spring and fall. Historically, trees were confined to the more elevated and better drained stream sides or ridges, forming "gallery forests", and acted to divide the Coastal Prairie into many subunits or "coves". The intrinsic soil conditions and frequent burning from lightening strikes prevented invasion by woody trees and shrubs and maintained the prairie vegetation. The natural demarcation line between the forest and grassland was (and is) very sharp. Coastal Prairie vegetation is extremely diverse and dominated by grasses, including *Paspalum plicatulum* (brownseed paspalum), *Paspalum* spp. (paspy grasses), *Schizachyrium scoparium* and *S. tenerum* (little and slender bluestem), *Andropogon gerardii* (big bluestem), *Andropogon* spp. (broomsedges), *Aristida* spp. (three-awn grasses), *Eragrostis* spp. (love grasses), *Spartina patens* (wire grass, near marshes), *Panicum virgatum* (switch grass), *Panicum* spp. (panic grasses), *Sorghastrum nutans* (Indian grass), *Sporobolus* spp. (dropseeds), and *Tridens* spp. (purple-top). Important sedges in the community include *Carex* spp. (caric sedges), *Cyperus* spp. (umbrella sedges), *Rhynchospora* spp. (beaked sedges), and *Scleria* spp. (nut-rushes). An abundance of forbs is present including *Cacalia ovata* (Indian platain), *Helianthus mollis* (sunflower), *Liatris* spp. (blazing-stars), *Asclepias* spp. (milkweeds), *Silphium* spp. (rosin-weeds), *Petalostemum* spp. (prairie clovers), *Baptisia* spp. (indigos), *Amsonia tabernaemontana* (blue star), *Rudbeckia* spp. (brown-eyed susans), *Euphorbia* spp. (spurges), *Euthamia* spp. (flat-topped goldenrods), *Hedyotis nigricans* (bluets), *Ruellia humilis* (wild petunia), *Ludwigia* spp. (water primroses), *Coreopsis* spp.

(tickseeds), *Solidago* spp. (goldenrods), *Agalinis* spp. (false foxgloves), and *Eupatorium* spp. (thoroughworts) (Allen et al. 2001, Grace et al. 2000, LNHP 1986-2004). Many plants in Coastal Prairie also occur in the pine savannahs and flatwoods that occur immediately north of the coastal prairie region. These include many of the above, plus *Drosera brevifolia* (sundew), *Polygala* spp. (milkworts), *Aletris* spp. (colic-roots), *Rhexia* spp. (meadow beauties), and *Sabatia* spp. (rose-gentians). As mentioned previously, fire plays a critical role in this natural community. Certain woody species may invade this habitat without periodic fire. The introduced species *Triadica sebifera (=Sapium sebiferum;* Chinese tallow tree) has become especially problematic, forming dense thickets or forests. The transition zone from coastal prairie to pine savannah is extremely diverse with the two habitat types sharing most herbaceous species in the transitional area. Baygalls or bayhead swamps may be included within coastal prairie.

Current Extent and Status:



Remnant Louisiana coastal prairies, once covering an estimated 2.5 million acres, have been reduced to less than 1 % of the original extent (Smith 1993). The disappearance of the coastal prairie can be attributed to rice and sugar cane production, oil exploration, and residential and commercial development. The current estimated upland prairie remnant extent is 93 acres and approximately 500 acres remain of the wet or marsh fringing prairie (L. Allain, personnal commmunication). The majority of the upland remnants exist along railroad right-of-ways between railroad tracks and highways. Many of these are threatened by highway widening projects, and fire suppression. Sabine NWR, managed by the USFWS, supports at least two known intact marsh fringing prairies with a total estimated area of 100 acres. White Lake Wetland Conservation Area, managed by the LDWF, has a wet prairie site of unknown condition and size. There are other wet prairies located on private lands, currently with no protection. Prairie restoration efforts began in the late 1980's, and there are 3 primary sites that have had some degree of success. The Eunice Prairie, owned by the Cajun Prairie Habitat Preservation Society, is a 15-acre restoration site that is registered with the Natural Areas Registry Program. The Duralde Prairie, owned by the USFWS, is a 345 acre restoration project, and another privately owned tract near Gueydan, Louisiana is being restored with the help of the NRCS and USGS.

COASTAL PRAIRIES SPECIES OF CONSERVATION CONCERN (24)		
AMPHIBIANS	American Woodcock	**BUTTERFLIES**
Southern Crawfish Frog	Short-eared Owl	Reakirt's Blue
	Scissor-tailed Flycatcher	Little Metalmark
BIRDS	Sprague's Pipit	Southern Dogface
Mottled Duck	Loggerhead Shrike	
Northern Harrier	Dickcissel	**MAMMALS**
Northern Bobwhite	Field Sparrow	Eastern Spotted Skunk
Yellow Rail	Grasshopper Sparrow	
Black Rail	Henslow's Sparrow	**REPTILES**
Sandhill Crane	Le Conte's Sparrow	Ornate Box Turtle
Whooping Crane		Western Slender Glass Lizard

Priority Species Research and Survey Needs:

Ornate Box Turtle: Initiate surveys in areas identified by SWG project T20 (Lorenze et al. 2004) to update occurrence and abundance data for inclusion in the LNHP database.

Waterbirds: Continue to conduct rookery surveys to update the LNHP database information.

Mottled Ducks: Research is needed on nesting success, brood rearing and brood success rates, molting habitat needs, and annual recruitment and survival rates along with other basic research to determine breeding and recruitment constraints.

Sandhill Cranes: Develop a monitoring program to determine their use of this habitat.

Short-eared Owl: Christmas Bird Count data indicate a significant decline in North America between 1960 and 1989. Expand efforts to locate and study wintering populations to determine limiting factors, management needs, and provide data necessary for habitat protection efforts.

Reakirt's Blue, Little Metalmark, Southern Dogface: Conduct surveys to determine current distribution and abundance for inclusion in the LNHP database.

Species Conservation Strategies:

1. Northern Bobwhite and Grassland Birds: Support implementation of recommended habitat restoration actions specified in NBCI and by LDWF Quail and Grassland Bird Task Force.
2. Shorebirds, Wading Birds:
   - Provide public education regarding the importance of waterbird nesting colonies and shorebird feeding areas. Reduce the negative effects of recreational and other uses on these areas.
   - Work with landowners to implement management and conservation recommendations for waterbirds (especially rails) of SWG project T18 upon completion.

3. Waterfowl:
   - Continue to encourage the creation/enhancement/maintenance of high-quality habitat across Louisiana.
   - Work with DU, DW, and USFWS to assuring that quality habitat, including refuge from hunting and other disturbance, is distributed across the landscape.
   - Encourage maintenance of rice agriculture and discourage conversion to crops with lower value to waterfowl.
   - Continue LDWF partnerships with DU, DW, USWFS, and state wildlife management agencies to conserve habitat on the northern breeding grounds.
4. Partner with LSU and ULL to develop/update management guidelines/BMPs for species of conservation concern that occur in lands cultivated for rice and sugarcane.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat			
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Conversion to agriculture or other forest types		XXX		XXX
Development/maintenance of pipelines, roads or utilities		XXX		XXX
Fire suppression	XXX			
Grazing practices	XXX		XXX	
Invasive/alien species	XXX			

Habitat Conservation Strategies:

1. Partner with NGOs, state and federal agencies, private landowners, etc. to promote protection, restoration, and expansion of coastal prairie habitat.
2. Promote fire as essential management tool. Burn these areas as needed and promote alternatives to fire where prescribed burning is not an option.
3. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamphlets and the LDWF website.
4. Review existing grassland management plans and incorporate NBCI strategies to encourage restoration of this habitat type.

5. Support Louisiana Native Plant Initiative located at McNeese State University for the development of plant materials to facilitate restoration of coastal prairies, and help develop partnerships to secure long-term funding for the plant materials center.
6. Support research to determine grazing schedules, etc. regarding possible livestock production on restored coastal prairie sites as a management technique.
7. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots in this habitat type.
8. Investigate restoration of coastal prairie on White Lake Wetlands Conservation Area.
9. Partner with NRCS to encourage farmers to plant native prairie plant species on agricultural buffer areas (CP33).
10. Partner with DOTD and federal agencies to promote the planting of native prairie species in rights-of-way areas where historic native prairies occurred.
11. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.

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14. Cypress-Tupelo-Blackgum Swamps

Rarity Rank: S4/G3G5
Synonyms: Freshwater Swamp, Brake, Swamp Forest
Ecological Systems:
CES203.490 Lower Mississippi River Bottomland Depression
CES203.065 Red River Large Floodplain Forest
CES203.384 Southern Coastal Plain Nonriverine Basin Swamp
CES203.459 West Gulf Coastal Plain Near Coast Large River Swamp

General Description:

(Note: Baldcypress Swamp (S4), Baldcypress-Tupelo Swamp (S4), Tupelo-Blackgum Swamp (S4), Pondcypress/Blackgum Swamp (S1), Scrub/Shrub Swamp (S4S5), and Shrub Swamp (S4S5) are described as distinct communities in the LNHP Natural Communities of Louisiana. They are considered together here due to their floristic similarity and/or similarity in management needs.)

Cypress-Tupelo-Blackgum Swamps throughout the natural range, are forested, alluvial swamps growing on intermittently exposed soils most commonly along rivers and streams but also occuring in backswamp depressions and swales. The soils are inundated or saturated by surface water or ground water on a nearly permanent basis throughout the growing season except during periods of extreme drought. However, even deepwater swamps, with almost continuous flooding, experience seasonal fluctuations in water levels (LNHP 1986-2004). Baldcypress swamps generally occur on mucks and clays, and also silts and sands with underlying clay layers (Alfisols, Entisols, Histosols, and Inceptisols) (Conner and Buford 1998).

Cypress-Tupelo-Blackgum swamps have relatively low floristic diversity. *Taxodium distichum* (baldcypress) and *Nyssa aquatica* (tupelo gum) are co-dominants. Common associates are *Nyssa sylvatica* var. *biflora* (swamp blackgum), *Acer rubrum* var. *drummondii* (swamp red maple), *Salix nigra* (black willow), *Fraxinus profunda* (pumpkin ash), *F. pennsylvanica* (green ash), *Planera aquatica* (water elm), *Gleditsia aquatica* (water locust), *Itea virginica* (Virginia willow), and *Cephalanthus occidentalis* (buttonbush). Composition of associate species may vary widely from site to site. Undergrowth is often sparse because of low light intensity and long hydroperiod. Neither

bald cypress nor tupelo gum seeds germinate underwater, nor can young seedlings of these trees survive long submergence. Establishment of young trees can only occur during periods of exceptionally long drought. This probably explains why these species tend to occur in even-aged stands since the environmental conditions favorable for germination and establishment of saplings occur very infrequently.

Those areas dominanted by tupelo and blackgum are also alluvial but occur on higher topographic positions than baldcypress dominated swamps. Baldcypress is a common associate, along with *Quercus laurifolia* (laurel oak), *Leucothoe racemosa* (leucothoe), *Cyrilla racemiflora* (swamp cyrilla), and *Cornus foemina* (swamp dogwood). *Taxodium ascendens* (pondcypress), along with swamp blackgum dominate a limited number of swamps making this natural community rare in Louisiana. This type seems to be confined to areas along the lower Pearl River, and adjoining the north shore of Lake Pontchartrain and Lake Maurepas (Smith 1999). Pondcypress/Blackgum swamps appear to occupy the backwater portions of larger swamplands, in places much removed from active stream channels. They are related to and often grade into baldcypress swamps more influenced by river flooding (Smith 1999).

Current Extent and Status:

Cypress-tupelo-blackgum swamps may be found throughout Louisiana, and sizeable areas of swamp still remain, even though the historic extent is considerably reduced. Statewide estimates of swamp loss range from 25 to 50 % of the original presettlement acreage and old-growth examples are very rare (Smith 1993, The Nature Conservancy 2004). The Atchafalaya Basin Floodway contains the greatest remaining contiguous acreage in the United States with an estimated 595,000 acres of collective swamp and bottomland hardwoods, the majority of which is privately owned. Large tracts also occur on some state LDWF WMAs with an estimated total of 97,107 acres, USFWS NWRs such as Cat Island, and properties under the administration of the COE. Some of these large swamp tracts occur in Louisiana's ECGP and are contained within the Bogue Chitto NWR and Pearl River WMA. The lower Tangipahoa River in Tangipahoa Parish, as well as, the Tickfaw and Amite Rivers in Livingston Parish and lands surrounding Lakes Pontchartrain and Maurepas also support large remaining tracts of cypress-tupelo-blackgum swamps (approximately 213,000 acres) (Governor's Science Working Group on Coastal Wetland Forest Conservation and Use 2005). Approximately 50 percent of these swamps fall on state WMAs (Joyce, Maurepas, and Manchac), and the other half are primarily privately owned. The Barataria Basin with 242,000 acres and Lake Verret area with 101,000 acres

contain extensive freshwater swamps, again in private ownership. Louisiana State Parks including Chicot, Lake Fausse Pointe, Tickfaw, and Bogue Chitto provide some small refuge for Louisiana's swamps. A total of 4,400 acres of combined swamps and bottomland hardwood forests are registered with the Louisiana Natural Areas Registry Program. And finally, there are a few scattered local community parks containing swamps throughout the state such as Baton Rouge's small 65 acre Bluebonnet swamp operated by Recreation and Park Commision for the Parish of East Baton Rouge.

All of Louisiana's swamps are threatened by land loss and encroaching interests, however, the swamps of the lower Mississippi River Alluvial Plain in south central and southeastern Louisiana face additional peril from subsidence, altered hydrology, coastal erosion, and saltwater intrusion. All of these factors combine to promote rapid loss and prevent adequate regeneration of these swamps.

CYPRESS – TUPELO - BLACKGUM SWAMP SPECIES OF CONSERVATION CONCERN (18)		
AMPHIBIANS	Yellow-throated Vireo	**MAMMALS**
Southern Dusky Salamander	Northern Parula	Southeastern Shrew
	Prothonotary Warbler	Southeastern Myotis
BIRDS	Swainson's Warbler	Louisiana Black Bear
Yellow-crowned Night-Heron	Kentucky Warbler	Long-tailed Weasel
Wood Stork	Hooded Warbler	
Swallow-tailed Kite		**REPTILES**
Bald Eagle	**BUTTERFLIES**	Alligator Snapping Turtle
Yellow-billed Cuckoo	'Seminole' Texan Crescent	

Priority Species Research and Survey Needs:

Southern Dusky Salamander: Apparently extirpated from numerous swamp sites throughout the State. Causes for its disappearance are unknown. Solicit assistance from interested parties to search for dusky salamanders.

Swallow-tailed Kite: Continue inventory and monitor Swallow-tailed Kites on public and private lands to fill data gaps in the distribution and abundance for inclusion in the LNHP database and Audubon nationwide database.

'Seminole' Texan Crescent: Conduct surveys to determine current distribution and abundance for inclusion in the LNHP database.

Songbirds: Continue to conduct research needed to assess silviculture/land management practices and the effects on all songbird species.

Waterbirds: Continue to conduct rookery surveys to update the LNHP database.

Species Conservation Strategies:

1. Swallow-tailed Kite: Implement conservation and management recommendations of SWG project T9 (Coulson 2004).
2. Bald Eagle: Continue with long-term monitoring of active bald eagle nests, successful breeding pairs, and fledged eagles.
3. Louisiana Black Bear: Partner with the BBCC, USFWS and continue to support the implementation of recovery efforts for this species.
4. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat					
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns	Sedimentation
Channelization of rivers or streams					XXX	XXX
Construction of ditches, drainage or diversion systems	XXX				XXX	XXX
Development/ maintenance of pipelines, roads or utilities		XXX	XXX	XXX	XXX	XXX
Incompatible forestry practices	XXX					XXX
Invasive/alien species	XXX					
Operation of dams or reservoirs	XXX				XXX	XXX

Habitat Conservation Strategies:

1. Work with landowners/land managers to promote conservation of habitat sites that may not regenerate naturally after logging due to changes in hydrology, herbivory, and other factors. Promote use of "condition classes" as defined by the Governor's Science Working Group on Coastal Wetland Forest Conservation and Use to identify these target swamp habitat areas in need of conservation attention.
2. Work with and support efforts of LCA, CWPPRA, and Governor's Commission on Coastal Wetland Forest Conservation and Use regarding coastal restoration

(specifically swamp habitat restoration, regeneration, and sustainability) and to establish and maintain long-term monitoring sites within coastal wetland forests.
3. Promote use of appropriate silvicultural techniques to restore/manage swamps for wildlife (include importance of tree species diversity, den trees for birds and mammals, etc.).
4. Work with Cypress Legacy Program and other environmental groups to identify old-growth areas where conservation actions can be implemented.
5. Support research to determine the importance of Spanish moss to species of conservation concern and determine if moss is declining in Louisiana.
6. Work with adjoining states to address water management issues that affect cypress-tupelo-blackgum swamps in Louisiana.
7. Work with COE, DU and other groups to enhance swamp hydrologic conditions to control invasives on Caddo Lake and Catahoula Lake.
8. Work with COE to influence water levels in the Atchafalaya Basin to benefit this habitat type.
9. Continue to monitor nuisance species (nutria, beaver, etc.) and control them as needed.
10. Partner with state and federal agencies and other interested groups to conduct surveys and develop GIS data on the extent and condition of swamps throughout Louisiana.

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15. Eastern Hillside Seepage Bog

Rarity Rank: S2/G2
Synonyms: Pitcher Plant Bog, Herbaceous Bog, Bog, Hillside Seep, Hillside Bog
Ecological Systems: CES203.078 Southern Coastal Plain Herbaceous Seepage Bog

General Description:

Hillside seepage bogs are open, mostly treeless, herb-dominated natural wetlands of hilly, sandy uplands historically dominated by longleaf pine of the East and West Gulf Coastal Plains in Louisiana. In the East Gulf Coastal Plain, these bogs occur on the Pleistocene high terraces in Washington and St. Tammany Parishes, arising commonly on mid- to low slopes, on saturated, strongly acidic (pH ca. 4.5 - 5.5) and nutrient-poor substrates of fine sandy loams or loamy fine sands with relatively high organic matter content (Smith 1996, Plummer 1963). Soil series names have generally not been assigned to bogs due to the naturally very limited acreage in the state (Smith 1996).

These bogs are generally persistently wet from seepage, and are variable in size being most often less than 1 acre but rarely exceeding 10 acres. EGCP bogs are underlain by an impervious clay layer that, when conditions are right, causes ground water to constantly seep to the soil surface. The herbaceous groundcover is dense, continuous and floristically rich. It is dominated by sedges, grasses and grass-like plants, and many kinds of unusual forbs, including pitcher-plants (*Sarracenia* spp.) and a variety of orchid species. Patches of shrubs are often present within bogs, and can become more prevelant, possibly degrading the habitat, if fire is excluded from the system. Since hillside bogs are embedded in what are now or historically were longleaf pine forests, they are fire-driven systems. They evolved with frequent growing-season fire events. Among other things, frequent fire deters invasion by shrubs and trees and stimulates growth, flowering and seed production by indigenous bog herbs (Barker 1980).

The degree to which a bog remains wet throughout the year depends on the size of the watershed, the soil infiltration rate upslope, the rate of saturated flow in the soil, the topographic position of the bog, the bog's water storage capacity, and the rate of water leaving the bog from evapo-transpiration and through surface and sub-surface flow. In

general, the greater the infiltration rate of the watershed soils and the water holding capacity of bog soils, the smaller recharge area needed to maintain seepage throughout dry periods of the year. Therefore, bogs are extremely sensitive to surrounding land management activities, and are easily degraded or destroyed by activities that alter natural hydrologic regimes.

Hillside seepage bogs are rich in herbaceous plant species, primarily grasses and grass-like plants (graminoids), although a large variety of forbs are present. There appears to be a distinct relationship between the number of species present and bog size (MacRoberts and MacRoberts 1992, 1993); more than 100 plant species may be found in a relatively large bog (MacRoberts and MacRoberts 1988). Many species are restricted to this habitat and closely allied longleaf pine flatwood savannahs.

Vegetation dominants include: *Andropogon* spp. (bluestems), *Aristida* spp. (threeawn grasses), *Panicum* spp. (panic grasses), *Ctenium aromaticum* (tooth-ache grass), *Muhlenbergia capillaris* (hairawn muhly), *Rhynchospora* spp. (beak-rushes), *Rhynchospora stenophylla* (narrow-leaved beakrush, S1G4), *Xyris* spp. (yellow-eyed grasses), *Eriocaulon* spp. (pipeworts), *Lachnocaulon* spp. (bog buttons), *Dichromena latifolia* (giant white top sedge), *Scleria* spp. (nut-rushes), *Fuirena* spp. (umbrella grasses), and *Fimbristylis* spp. (fimbry-sedge). Primary forbs include *Sarracenia alata* (green pitcher plant), *Rhexia* spp. (meadow beauties), *Polygala* spp. (milkworts), *Liatris* spp. (blazing stars), *Aletris lutea* (colic-root), *Eupatorium* spp. (thorough-worts), *Coreopsis linifolia* (narrow-leaved tickseed), *Drosera* spp. (sundews). Many rare forbs are found in EGCP bogs including *Sarracenia psittacina* (parrot pitcherplant, S3G4), *Pinguicula lutea* (yellow butterwort, S2G4G5), *Lilium catesbaei* (southern red lily, S1G4), *Tofieldia racemosa* (coastal false-asphodel, S2S3G5), *Lophiola aurea* (golden crest, S2S3G4), and *Macranthera flammea* (flame flower, S2G3). Various orchids, especially *Platanthera* spp. (fringed orchids), are often conspicuous members of the flora. Ferns (principally *Osmunda* spp.) and club-mosses (*Lycopodium* spp.) are usually present and sphagnum moss is often abundant (LNHP 1986-2004, MacRoberts and MacRoberts 1988, 1993a, 1993b, 1991).

Current Extent and Status:

Hillside seepage bogs in the EGCP of Louisiana are naturally small in size, and historically were embedded within longleaf pine forests. Presettlement extent of seepage bogs in the EGCP of Louisiana is estimated at less than 2,000 acres, with only 10 to 25% currently remaining in St. Tammany and Washington Parishes (Smith 1993). These present day bogs are most often found surrounded by commercial timberlands, being too wet and other soil conditions unfavorable for commercial tree production, or along powerline and pipeline right-of-ways where management practices such as mowing to keep shrubs and other

woody vegetation under control have allowed the bog plants to persist (Sheridan et al. 1997). There is currently only minimal protection for remaining bogs. TNC's Abita Creek Preserve in St. Tammany Parish contains a seepage bog of approximately 8 acres. There is one very small, privately owned bog of less than 1 acre registered with the Louisiana Natural Areas Registry Program, and a 1-acre bog, owned by a commercial timber company, has been given a "special site" designation by that company. No bogs are known from federal or state public lands in the EGCP. A larger, 20-acre bog, containing at least 5 species of state rare and one globally rare plant species, is privately owned and current status of this bog is unknown.

EASTERN HILLSIDE SEEPAGE BOG SPECIES OF CONSERVATION CONCERN (8)			
AMPHIBIANS	**BIRDS**	**BUTTERFLIES**	**MAMMALS**
Gulf Coast Mud Salamander	Sedge Wren	Arogos Skipper	Southeastern Shrew
Southern Red Salamander	Henslow's Sparrow		Long-tailed Weasel
	Le Conte's Sparrow		

Priority Species Research and Survey Needs:

Sedge Wren, Henslow's Sparrow, Le Conte's Sparrow: Continue to inventory and monitor this species and its habitat on public and private lands to fill data gaps in species distribution and abundance for inclusion in the LNHP database and the Audubon nationwide database.

Gulf Coast Mud Salamander, Southern Red Salamander: Gulf Coast Mud Salamander; recently (post 1960s) recorded from only one site in Louisiana. Conduct surveys to determine current distribution and abundance of both species for inclusion in LNHP database.

Arogos Skipper: Conduct surveys to determine its current distribution and abundance for inclusion in the LNHP database.

Southeastern Shrew: Considered imperiled in Louisiana. Together with Arkansas and Missouri, Louisiana represents the western edge of its range. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Species Conservation Strategies:

1. Henslow's Sparrow: Implement conservation and management recommendations of SWG projects T22 and T32 upon completion.
2. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS endangered and threatened species recovery plans over the next 10 years.
3. Document habitat relationships of priority species to determine how dependent they are upon this habitat type, relative to other habitat types.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat			
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Modification of Water Levels; Changes in Natural Flow Patterns
Construction of ditches, drainage or diversion systems	XXX		XXX	XXX
Conversion to agriculture or other forest types		XXX		
Development/maintenance of pipelines, roads or utilities			XXX	
Fire suppression	XXX			
Incompatible forestry practices	XXX		XXX	XXX
Invasive/alien species	XXX			
Residential development		XXX	XXX	

Habitat Conservation Strategies:

1. Conduct surveys to determine extent and condition of this habitat type with a focus on identifying the surrounding landscape context (i.e., residential developments, etc.) that might be affected by prescribed burning.
2. Once bogs are identified, conduct landowner surveys to aid in the development of management strategies for these sites.
3. Continue to encourage landowners to implement BMPs and adopt Sustainable Forestry Initiative (SFI) standards in the management of this habitat type.
4. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots in this habitat type.
5. Promote utilization of federal cost share programs (NRCS) to address invasive species problems.
6. Provide additional cost share funds for landowners to drastically reduce or eliminate costs associated with conducting prescribed burns on their property.
7. Provide education/outreach to promote conservation and preservation of this habitat type.
8. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.

9. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.

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16. Eastern Longleaf Pine Savannah

Rarity Rank: S1/G1
Synonyms: Pine Savannah, Pine Flatwood, Grass-Sedge Bog, Pitcher-Plant Prairie, Pitcher-Plant Meadow, Pitcher-Plant Bog, Herbaceous Bog, Flatwood Bog
Ecological Systems: CES203.375 East Gulf Coastal Plain Near-Coast Pine Flatwoods

General Description:

Longleaf pine flatwood savannahs (pine savannahs) are floristically rich, herb-dominated wetlands, that are naturally sparsely stocked with longleaf pine (*Pinus palustris*). They historically dominated the Gulf coastal plain flatwood regions of southeast and southwest Louisiana EGCP and LWGCP. The term "savannah" is classically used to describe expansive herb-dominated areas with scattered trees (Smith 1996).

Pine savannahs are found naturally on broad "flats" occupying the poorly drained and seasonally saturated/flooded depressional areas and low flats. These communities are subject to a highly fluctuating water table, from surface saturation and shallow flooding in late fall/winter/early spring to growing-season droughtiness. In the EGCP, pine savannahs are commonly associated with mesic pine flatwoods intermingled on slight rises and low ridges, and typically grade down slope to slash pine-pondcypress/hardwood forest, bayhead swamp and/or small stream forest (LNHP 1986-2004). Soils in eastern longleaf savannahs are hydric, very strongly acidic, nutrient-poor fine sandy loams and silt loams, low in organic matter. The soils may be underlain by an impeding layer, are slowly permeable and water runs off the surface slowly. Some common soils are Myatt fine sandy loam, Guyton silt loam, and Stough fine sandy loam.

For the most part, savannah remnants seen today are relatively limited in size compared to the broad expanses that once existed. Presettlement habitat was a very open "forest" (canopy cover averaged much less than 50%), with the scattered trees almost exclusively longleaf pine. Few shrubs and hardwoods were encountered, except in wetter depressional acid swamps (e.g., slash pine-pond cypress/hardwood forest and bayhead swamp) and along creek bottoms that bisected the flatwoods region (Smith 1996). Fire, soil conditions and a seasonally high water table work in concert to control community structure in longleaf pine flatwood savannahs, but fire is considered the critical element in their maintenance. All of the species indigenous to pine savannahs have evolved over millennia within a regime of frequent (once every 1 to 4 years) lightning-season surface fires and most depend on fire for perpetuation in their natural habitat. Among other things, fire stimulates flowering and fruit/seed production of savannah herbs and

pyrophytic shrubs, deters invasion by fire-intolerant woody vegetation, and exposes mineral soil for seedlings of indigenous herbs and longleaf pine to become established. In the absence of frequent burning, pine savannahs quickly succeed into shrub/tree thickets, and sun-loving herbs are reduced and most are eventually eliminated without fire (Smith 1996).

Pine savannahs support a rich variety of plant species. The community is most often dominated by numerous types of grasses and sedges, but is noted by many for its interesting collection of insectivorous plants and showy orchids, lilies and others, and for its very high floristic diversity. Many of the plants known from pine savannahs are restricted to this habitat or closely-allied hillside bogs. Common woody species include *P. palustris* (longleaf pine, usually predominant tree species), *Pinus elliottii* (slash pine, in EGCP), *Magnolia virginiana* (sweet bay), *Nyssa sylvatica* (blackgum), *Quercus virginiana* (live oak), *Q. marilandica* (blackjack oak), *Q. laurifolia* (laurel oak), *Cyrilla racemiflora* (swamp cyrilla), *Morella* spp. (waxmyrtles), *Hypericum* spp. (St. John's worts), and *Styrax americana* (littleleaf snowbell). *Taxodium ascendens* (pondcypress, in EGCP) may occur but is usually restricted to slightly lower areas within the site. Herbaceous vegetation of pine savannahs is very diverse, dominated by graminoids, and similar to that occurring in hillside bogs. Graminoids present include *Andropogon* spp. (broomsedges), *Schizachyrium scoparium* and *S. tenerum* (little and slender bluestem), *Panicum* spp. (panic grasses), *Aristida* spp. (three-awn grasses), *Ctenium aromaticum* (toothache grass), *Muhlenbergia capillaris* (hairawn muhly), *Erianthus* spp. (plume-grasses), *Coelorachis* spp. (jointgrasses), *Rhynchospora* spp. (beak-rushes) including *Rhynchospora chapmanii* (S2) and *Rhynchospora compressa* (S1S2), *Xyris* spp. (yellow-eyed grasses), *Fuirena* spp. (umbrella grasses), *Scleria* spp. (nut-rushes), *Dichromena latifolia* (giant white top sedge), *Eriocaulon* spp. (pipeworts), *Lachnocaulon* spp. (bog buttons), and *Fimbristylis* spp. (fimbry-sedge). Some forbs common in the community include *Sarracenia* spp. (pitcherplants) including *Sarracenia psittacina* (parrot pitcherplant, S3), *Agalinis* spp. (gerardias), *Lobelia* spp. (lobelias), *Rhexia* spp. (meadow beauties), *Eryngium integrifolium* (bog thistle), *Oxypolis filiformis* (narrow-leaved hog-fennel), *Polygala* spp. (milkworts), *Liatris* spp. (blazing-stars), *Sabatia* spp. (rose-gentians), *Drosera* spp. (sundews), *Pinguicula* spp. (butterworts) including *Pinguicula lutea* (S2), *Utricularia* spp. (bladderworts), and *Platanthera* spp. (fringed-orchids). Various additional species belonging to the lily family (Liliaceae) including *Aletris lutea* (yellow colic-root) and *Tofieldia racemosa* (coastal false-asphodel, S2S3), species from the sunflower family (Asteraceae) including *Carphephorus pseudoliatris* (chaffhead), and members of the orchid family (Orchidaceae) including *Cleistes bifaria* (spreading pogonia, S1) are prominent. *Lycopodium* spp. (club-mosses) and sphagnum moss are often abundant (Smith 1996, LNHP 1986-2004).

Current Extent and Status:

Historically the eastern Florida Parishes of Louisiana were dominated by extensive stands of longleaf pine. Now barely 1 % of the original estimated 100,000 to 500,000 acres of longleaf pine savannahs remains. Land conversion, development, and timber

production were initial factors in this habitat loss. Today there are a few thousand acres in small blocks scattered across this area. TNC protects and manages about 4,272 acres of longleaf savannah on portions of their Abita Creek, Lake Ramsey and Talisheek Preserves. LDWF also owns and manages the larger portion of Lake Ramsey WMA, with 796 acres of savannah. The Big Branch, Pearl River, and Bogue Chitto NWF collectively contain about 7,000 acres of "pine flatwoods" with remnants of savannah herbaceous layers, and some of these sites are in the process of being restored to longleaf systems. A very few private tracts are recorded with the Louisiana Natural Areas Registry Program for a total of 13 acres. In light of the significant losses of this habitat and it's importance to numerous wildlife target species, it is critical that an inventory is conducted for all remaining savannah sites, followed by identification and prioritizaton of areas for conservation and restoration of this habitat type.

EASTERN LONGLEAF PINE SAVANNAH
SPECIES OF CONSERVATION CONCERN (37)

AMPHIBIANS
- Eastern Tiger Salamander
- Southern Dusky Salamander
- Four-toed Salamander
- Oak Toad
- Barking Treefrog
- Ornate Chorus Frog
- Eastern Spadefoot
- Dusky Gopher Frog

BIRDS
- Northern Harrier
- Northern Bobwhite
- Yellow Rail
- American Woodcock
- Chuck-Will's-Widow
- Red-cockaded Woodpecker
- Brown-headed Nuthatch
- Sedge Wren
- Loggerhead Shrike
- Prairie Warbler
- Bachman's Sparrow
- Field Sparrow
- Henslow's Sparrow
- Le Conte's Sparrow

BUTTERFLIES
- Yucca Giant Skipper
- Little Metalmark

MAMMALS
- Southeastern Myotis
- Southeastern Shrew
- Eastern Harvest Mouse
- Long-tailed Weasel
- Eastern Spotted Skunk

REPTILES
- Eastern Slender Glass Lizard
- Eastern Glass Lizard
- Northern Scarlet Snake
- Mole Kingsnake
- Scarlet Kingsnake
- Pine Woods Littersnake
- Southeastern Crowned Snake
- Harlequin Coralsnake

Priority Species Research and Survey Needs:

Northern Bobwhite: Populations have declined precipitously from 1980-1999, averaging 8.2% per year in BCR 25; 6.0% per year in BCR 26; 5.8% per year in BCR 27; 4.5% per year in BCR 37. Continue to monitor populations thru breeding bird and hunting surveys.

Bachman's Sparrow: Intensive surveys are needed to produce estimates of current population size statewide. Develop projects which determine relationship between population size and vegetation succession on quality sites. Determine whether management activities can create a mosaic of adjacent sites that together provide continuously occupied habitat. Determine dispersal behavior to maximize the benefits/effects of future habitat management.

Henslow's Sparrow: Obtain more information on winter habitat abundance, distribution, and habitat needs throughout Louisiana.

Bats: Conduct habitat use and life history studies for species that may potentially use this habitat (e.g., big brown bat, southeastern myotis).

Eastern Harvest Mouse: Considered vulnerable in Louisiana, intensive surveys needed to update occurrence records and abundance for inclusion in the LNHP database.

Songbirds:

- Continue to support research on silviculture/land management practices and their effects on all songbird species.
- Continue to monitor songbird abundance and reproductive success (with emphasis on species of conservation concern) in natural habitats as compared to commercial stands through the establishment of MAPS stations and BBS routes to determine species utilization patterns between these habitats.

Establish monitoring systems and protocols for medium and small mammals to determine current population abundances and trends in this habitat.

Determine the microhabitat preferences and requirements of species utilizing eastern longleaf pine savannah to understand how these species are utilizing this habitat and to determine management needs.

Species Conservation Strategies:

1. Henslow's Sparrow, Bachman's Sparrow:
   - Implement conservation and management recommendations of SWG projects T22 and T32 upon completion.
   - Monitor reproductive success of Bachman's sparrows to determine limiting factors.
   - Work with landowners to encourage use of BMPs for prescribed fire management and timber harvesting techniques to improve habitat quality.
2. Red-cockaded Woodpecker:
   - Continue to support implementation of the Louisiana Statewide Red-cockaded Woodpecker (RCW) Safe Harbor Program.
   - Support USFWS recovery efforts outlined in the RCW recovery plan, 2nd Revision.
   - Encourage the establishment of new RCW populations.
   - Investigate potential land acquisition of this habitat type to increase and support new populations.
3. Northern Bobwhite and Grassland Birds: Support implementation of recommended habitat restoration actions specified in NBCI and by LDWF quail and grassland bird task force.
4. Eastern Slender Glass Lizard, Northern Scarlet Snake, Mole Kingsnake, Scarlet Kingsnake, Southeastern Crowned Snake, Harlequin Coralsnake: Observations on

this guild of longleaf specialists have declined significantly in recent years. Promote increased acreage and natural management of longleaf pine as a timber resource and substitute for loblolly monoculture.

5. Amphibians:
   - Develop educational information and management techniques to address ephemeral ponds and their importance to all amphibians, with emphasis on species of conservation concern, and make this information available to landowners/land managers through technical pamplets and the LDWF website.
   - Promote management recommendations developed by Partners for Amphibian and Reptile Conservation (PARC).
6. Encourage the retention of snags during logging operations to increase the number available for cavity-nesting wildlife species. Efforts need to be made to maintain sufficient levels of woody debris in stands for reptiles, amphibians and small mammals.
7. Document the habitat relationships of species of conservation concern and how dependent they are upon eastern longleaf pine savannah, relative to other habitat types.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat				
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns
Commercial/industrial development		XXX		XXX	
Construction of ditches, drainage or diversion systems	XXX	XXX	XXX		XXX
Conversion to agriculture or other forest types		XXX		XXX	
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX	
Fire suppression	XXX				
Incompatible forestry practices	XXX		XXX		XXX
Invasive/alien species	XXX				
Residential development		XXX	XXX	XXX	

Habitat Conservation Strategies:

1. Conduct surveys to determine extent and condition of this habitat type with a focus on identifying the surrounding landscape context (i.e., residential developments, etc.) that might be affected by prescribed burning management.
2. Educate landowners, adjacent residents, developers, and the general public about the crucial role of prescribed burning in the management of longleaf pine systems (multi-agency, multi-group effort).
3. Encourage longer rotation ages when compatible with the landowner's management objectives.
4. Once savannahs are identified conduct landowner surveys to aid in the development of management strategies for these sites.
5. Promote the advantages of growing longleaf pine and associated herbaceous ground cover.
6. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots in this habitat type.
7. Promote utilization of state and federal cost share programs (Forest Land Enhancement Program (FLEP) and NRCS programs) to address invasive species problems.
8. Provide additional cost share funds through programs such as FLEP in order to drastically reduce or eliminate landowners' costs associated with conducting prescribed burns their property.
9. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.
10. Investigate the availability of additional cost-share funding opportunities, through FLEP, FPP or other programs, for landowners to reduce the cost of longleaf pine management.
11. Encourage a university curriculum that incorporates the identification of sensitive natural areas into student studies (especially landscape architecture and courses for planners).
12. Work with the Longleaf Alliance to incorporate their strategies for longleaf pine management and restoration into current restoration efforts.

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17. Eastern Upland Longleaf Pine Forest

Rarity Rank: S1S2/G1G2
Synonyms: Sandhill Pine Forest
Ecological Systems:
CES203.496 East Gulf Coastal Plain Interior Upland Longleaf Pine Woodland

General Description:

This community type occurs in the hilly uplands of the central and eastern Florida Parishes of Louisiana. It occurs on acidic loamy sands to acid clays associated with Pleistocene terraces. The gopher tortoise (*Gopherus polyphemus*), federally-listed as a threatened species and requiring sandy soils and an open herbaceous understory, is found in this habitat. The community is characteristically dissected by small to large branch or creek bottoms. *Pinus palustris* (longleaf pine) is the dominant overstory species, and in locations where fire has frequently occurred, it is often the only canopy species. Where fire is less frequent or suppressed, a number of overstory associates may occur, including *Pinus echinata* (shortleaf pine), *Pinus taeda* (loblolly pine), *Nyssa sylvatica* (black gum), *Liquidambar styraciflua* (sweetgum), *Q. stellata* (post oak), *Q. marilandica* (blackjack oak), *Q. shumardii* (shumard oak), *Q. alba* (white oak), *Q. nigra* (water oak), *Prunus serotina* (black cherry), *Acer rubrum* (red maple), *Diospyros virginiana* (persimmon), and *Sassafras albidum* (sassafras). Significant shrub species include *Cornus florida* (flowering dogwood), *Vaccinium arboreum* (winter honeysuckle), *V. elliottii* (elliott's blueberry), *V. stamineum* (deer berry), *V. darrowii* (dwarf blueberry), *Gaylussacia dumosa* (dwarf huckleberry), *Callicarpa americana* (French mulberry), *Morella cerifera* (wax myrtle), *Bumelia lanuginosa* (chittum-wood), *Ilex vomitoria* (yaupon), *I. opaca* (American holly), *Rubus* spp. (blackberries), and *Rhus copallina* (winged sumac). Common vines include *Vitis* spp. (grapes), *Smilax* spp. (greenbriers), *Parthenocissus quinquefolia* (Virginia creeper), and *Gelsemium sempervirens* (yellow jessamine). The herbaceous flora may be exceedingly diverse if fire has frequently occured. Grasses, composites, and legumes are predominant in the ground layer. *Andropogon* spp. (broomsedges) and *Schizachyrium* spp. (bluestems) are usually the dominant grasses, but several other genera are usually present, including *Aristida* (three-awn grasses), *Sporobolus* (dropseeds), *Panicum* (panic grasses), *Anthaenantia* (silky scales), *Ctenium aromaticum* (toothache grass), *Digitaria* (crab grasses), *Eragrostis* (love grasses), *Erianthus* (plume grasses), *Gymnopogon* (skeleton grasses), *Muhlenbergia* (muhly grasses), *Paspalum* (paspy grasses), and *Setaria*

spp. (bristle grasses). Composites include *Eurybia* spp. and *Symphyotrichum* spp. (asters), *Carphephorus odoratissimus* (vanilla plant), *Chrysopsis* spp. (golden asters), *Heterotheca* spp. (golden asters), *Elaphantopus* spp. (elephant-foot), *Eupatorium* spp. (thoroughworts), *Euthamia* spp. (flat-topped goldenrods), *Gnaphalium* spp. (rabbit tobaccos), *Helenium* spp. (sneeze-weeds), *Helianthus* spp. (sunflowers), *Liatris* spp. (blazing-stars), *Rudbeckia* spp. (brown-eyed susans), *Solidago* spp. (goldenrods), and *Vernonia* spp. (ironweeds). Prominent legumes are *Baptisia* spp. (indigos), *Cassia* spp. (partridge-peas), *Centrosema virginianum* (butterfly pea), *Clitoria mariana* (pigeon wings), *Crotolaria* spp. (rattle pods), *Desmodium* spp. (beggar's ticks), *Lespedeza* spp. (bush clovers), *Stylsanthes biflora* (pencil-flower), *Rhynchosia* spp. (snout beans), and *Tephrosia* spp. (hoary peas). Additional frequent forbs include *Oenothera* spp. (evening primroses), *Polygala* spp. (milkworts), *Lobelia* spp. (lobelias), *Callirhoe papaver* (poppy-mallow), *Ruellia* spp. (wild petunias), *Hypoxis* spp. (yellow-eyed grasses), *Asclepias* spp. (mildweeds), *Lechea* spp. (pinweeds), *Euphorbia* spp. (spurges), *Sabatia* spp. (rose-gentians), *Agalinis* spp. (false foxgloves), and *Rhexia* spp. (meadow beauties). The fern *Pteridium aquilinum* (bracken fern) is often conspicuous in large colonies (LNHP 1986-2004).

Current Extent and Status:

Historically the eastern Florida Parishes of Louisiana were dominated by extensive stands of longleaf pine. Now only 1 to 5 % of the original estimated 1 to 2 million acres of upland longleaf pine forests remain (Smith 1993, 1999). Land conversion, development, and timber production were initial factors in this habitat loss. Today there are a few thousand acres in small blocks scattered across this area. The LDWF owns and manages Sandy Hollow WMA with 2,500 acres of upland longleaf forest. LDWF also manages a Tangipahoa Parish School Board longleaf tract of 1,000 acres, and Ben's Creek WMA, owned by Weyerhaueser, with about 100 acres of longleaf pine. The school board tract is in poor condition with a thick woody understory due to fire suppression. The Office of State Lands manages a 200-acre longleaf site, but it also has been fire suppressed. Both of these sites are restorable if proper management is applied in the very near future. Camp Whispering Pines, a 300-acre tract owned and managed by the Girl Scout Council of Southeast Louisiana, is an excellent example of longleaf habitat restoration. This site was also overgrown with woody shrubs and hardwood trees because fire had been excluded from the habitat. By returning controlled burning and incorporating other longleaf management techniques, the site has been once again restored to a healthy upland longleaf system. Louisiana State University's, Lee Memorial Forest has a small longleaf tract of approximately 50 acres, and there are about 1,100 acres of eastern upland longleaf registered with the Natural Areas Registry Program (this amount includes the Camp Whispering Pines tract).

EASTERN UPLAND LONGLEAF PINE FOREST SPECIES OF CONSERVATION CONCERN (33)		
AMPHIBIANS	Prairie Warbler	Long-tailed Weasel
Oak Toad	Bachman's Sparrow	Eastern Spotted Skunk
Barking Treefrog	Field Sparrow	
Ornate Chorus Frog	Henslow's Sparrow	**REPTILES**
Eastern Spadefoot	Le Conte's Sparrow	Gopher Tortoise
	Orchard Oriole	Eastern Slender Glass Lizard
BIRDS		Eastern Glass Lizard
Northern Bobwhite	**BUTTERFLIES**	Northern Scarlet Snake
American Woodcock	Yucca Giant Skipper	Mole Kingsnake
Chuck-Will's-Widow		Scarlet Kingsnake
Red-cockaded Woodpecker	**MAMMALS**	Black Pine Snake
Brown-headed Nuthatch	Southeastern Shrew	Southeastern Crowned Snake
Sedge Wren	Southeastern Myotis	Harlequin Coral Snake
Loggerhead Shrike	Big Brown Bat	Eastern Diamond-backed Rattlesnake

Priority Species Research and Survey Needs:

Brown-headed Nuthatch: Investigate the impacts of silviculture/land management on this species and causes of this species' decline.

Songbirds:

- Continue to support research on silviculture/land management practices and their effects on all songbird species.
- Develop long-term monitoring projects that focus on abundances and reproductive success (with emphasis on species of conservation concern) in this habitat type through the establishment of MAPS stations and BBS routes.

Yucca Giant Skipper: Conduct surveys to determine current distribution and abundance for inclusion in the LNHP database.

Species Conservation Strategies:

1. Northern Bobwhite and Grassland Birds: Support implementation of recommended habitat restoration actions specified in NBCI and by LDWF quail and grassland bird task force.
2. Red-cockaded Woodpecker:
   - Continue to support implementation of the Louisiana Statewide RCW Safe Harbor Program.
   - Support USFWS recovery efforts outlined in the RCW recovery plan, 2nd Revision.
   - Encourage the establishment of new RCW populations.
   - Investigate potential land acquisition of this habitat type to increase and support new populations.
3. Brown-headed Nuthatch: Encourage landowners to use group-selection and single-tree selection harvesting methods and maintain or increase the number of standing snags.

4. Henslow's Sparrow, Bachman's Sparrow:
   - Monitor reproductive success of Bachman's sparrows to determine habitat limiting factors.
   - Work with landowners to encourage use of BMPs for prescribed fire management and timber harvesting techniques to improve habitat quality.
   - Implement conservation and management recommendations of SWG projects T22 and T32 upon completion.
5. Eastern Slender Glass Lizard, Northern Scarlet Snake, Mole Kingsnake, Scarlet Kingsnake, Southeastern Crowned Snake, Harlequin Coralsnake: Observations on this guild of longleaf specialists have declined significantly in recent years. Promote increased acreage and natural management of longleaf pine as a timber resource and substitute for loblolly monoculture.
6. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat			
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Commercial/industrial development		XXX		
Conversion to agriculture or other forest types		XXX		XXX
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX
Fire suppression	XXX			
Incompatible forestry practices	XXX		XXX	
Invasive/alien species	XXX			
Residential development		XXX	XXX	XXX

Habitat Conservation Strategies:

1. Conduct surveys to determine extent and condition of this habitat type with a focus on identifying the surrounding landscape context (i.e., residential developments, etc.) that might be affected by prescribed burning.

2. Encourage longer rotation ages when compatible with the landowner's management objectives.
3. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots in this habitat type.
4. Educate landowners, adjacent residents, developers, and the general public about the crucial role of prescribed burning in the management of longleaf pine systems (multi-agency, multi-group effort).
5. Promote advantages of growing longleaf pine and associated herbaceous ground cover.
6. Promote utilization of state and federal cost share programs (FLEP and NRCS programs) to address invasive species problems.
7. Promote value-added products produced from longleaf pine to encourage landowners to replant longleaf pine instead of loblolly pine.
8. Provide additional cost share funds through programs such as FLEP in order to drastically reduce or eliminate landowners' costs associated with conducting prescribed burns on their property.
9. Investigate the availability of additional cost-share funding opportunities, through FLEP, FPP or other programs, for landowners to reduce the cost of longleaf pine management.
10. Work with the Longleaf Alliance to incorporate their strategies for longleaf pine management and restoration into current restoration efforts.
11. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.

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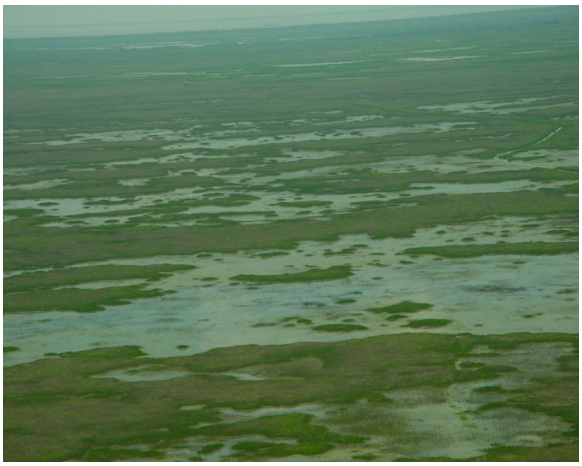
18. Freshwater Marsh

Rarity Rank: S1S2/G3G4
Synonyms: Fresh Marsh, Paille Fine (pronounced "pie feen") Marsh
Ecological Systems:
CES203.467 Gulf Coast Chenier Plain Fresh and Oligohaline Tidal Marsh
CES203.470 Mississippi Delta Fresh and Oligohaline Tidal Marsh

General Description:



Freshwater marsh is normally located adjacent to intermediate marsh along the northern most extent of the coastal marshes, although it may occur beside coastal Bays where freshwater is entering the bay (e.g., Atchafalaya Bay). Small pools or ponds may be scattered.

The floristic composition of these sites is quite heterogeneous and is variable from site to site. Frequency and duration of flooding which are intimately related to microtopography seem to be the primary factors governing species distributions. Substrate, current flow, salinity, competition, and allelopathy are also important in determining species distribution patterns. Freshwater Marsh has the greatest plant diversity and highest soil organic matter content of any marsh type. Chabreck (1972) reported 92 plant species in fresh marsh versus only 17 different species in salt marsh. It is frequently dominated by *Panicum hemitomon* (maidencane). Other characteristic species include *Eleocharis* spp. (spikesedge), *Sagittaria lancifolia* (= *S. falcata*;), *Alternanthera philoxeroides* (alligator weed), *Spartina patens* (wire grass), *Phragmites communis* (roseau cane), *Bacopa monnieri* (coastal water hyssop), *Ceratophyllum demursum* (coontail), *Cyperus odoratus* (fragrant flatsedge), *Eichhornia crassipes* (water hyacinth), *Pontederia cordata* (pickerelweed), *Peltandra virginica* (arrow arum), *Hydrocotyle* spp. (pennyworts), *Lemna minor* (common duckweed), *Myriophyllum* spp. (water milfoils), *Nymphaea odorata* (white waterlilly), *Typha* spp. (cattail), *Utricularia* spp. (bladderworts), *Vigna luteola* (deer pea), and *Zizaniopsis miliacea* (southern wildrice) (LNHP 1986-2004). Epiphytic and benthic algae are two other major autotroph groups in freshwater marsh. A significant portion of freshwater marsh is floating marsh (flotant) which occurs in the Deltaic Plain of Louisiana. Salinities are usually less than 2 ppt and normally average about 0.5-1 ppt.

Current Extent and Status:

Freshwater marsh has undergone the largest reduction in acreage of any of the marsh types over the past 20 years due mainly to salt water intrusion, canal dredging, and

commercial, industrial and residential development. Presettlement acreage was estimated at 1 to 2 million acres, but has been reduced by 25 to 50 % of this original extent (Smith 1993). The largest contiguous tracts of fresh marsh occur in Terrebonne, St. Mary, Vermillion, Cameron, LaFourche and St. Charles Parishes (Hartley et al. 2000). In the Chenier Plain of southwestern Louisiana, Sabine, Cameron Prairie, and Lacassine NWFs have a combined 75,121 acres of fresh marsh. State lands in the Chenier Plain include the White Lake Wetlands Conservation Area with approximately 52,000 acres of freshwater marsh, and Rockefeller Wildlife Refuge with a total area of 76,042 acres, approximately one-third of which is fresh marsh. Both of these conservation areas are managed by the LDWF. In the Deltaic Plain of southeastern Louisiana, LDWF lands with freshwater marsh habitat include the Atchafalaya Delta WMA (total land area of 19,000 acres and unknown acres of fresh marsh), Salvador WMA (30,000 acres), Timken WMA (3,000 acres), Pass-a-Loutre WMA at the terminous of the Mississippi River (115,000 total acres, the majority are canals and waterways with some freshwater and intermediate marsh), Pearl River WMA (total 36,000 acres with approximately one-fourth in freshwater and intermediate marsh), and very small amounts of freshwater marsh on Joyce and Maurepas Swamp WMAs. NWRs with freshwater marsh in the Deltaic Plain include the Delta NWR (48,800 acres of fresh and brackish marsh), Bayou Sauvage NWR (23,000 acres of fresh and intermediate marsh), Big Branch NWR (total land area of 15,000 acres and unknown acres of fresh and intermediate marsh), and Mandalay NWR (total land area of 4,212 acres of cypress swamp and some fresh marsh). One Natural Areas Registry site with fresh marsh in St. Charles Parish totals 82.5 acres, and TNC protects a total of 586 acres on their White Kitchen Preserve (unknown number of fresh marsh acres).

Wildlife populations are generally highest in this marsh type and it supports high numbers of wintering waterfowl. As with the other marsh types, freshwater marsh acts as important nursery areas for the young of many marine species, such as croaker, seatrout, blackdrum, and flounder. The community may change to a more saline marsh type because of salt water intrusion or may become open water. The drought periods of 1999 and 2000 have contributed to cattail invasions of freashwater ponds and led to substantial loss of open water ponds in freshwater marshes east of LA Hwy 27, and in other areas. "Flotant" creation has occurred in many areas and this is having an impact on waterfowl and other wetland species. Places which were open "black water" areas with good amounts of *Lemna* sp. have become non-waterfowl areas with choked up flotant and *Salvinina* sp. and other mat-forming plants taking over and has resulted in a great loss of waterfowl habitat.

FRESHWATER MARSH SPECIES OF CONSERVATION CONCERN (31)		
BIRDS	Black Rail	Short-eared Owl
American Bittern	Clapper Rail	Sedge Wren
Yellow-crowned Night-Heron	King Rail	Loggerhead Shrike
Wood Stork	Sandhill Crane	Nelson's Sharp-tailed Sparrow
Mottled Duck	Whooping Crane	
Northern Pintail	Marbled Godwit	**BUTTERFLIES**
Canvasback	Dunlin	Neamathla Skipper
Redhead	Short-billed Dowitcher	Dion Skipper
Lesser Scaup	Gull-billed Tern	Great Southern White
Bald Eagle	Caspian Tern	
Northern Harrier	Common Tern	**REPTILES**
Yellow Rail	Forster's Tern	Alligator Snapping Turtle

Priority Species Research and Survey Needs:

Dion Skipper, Neamathla Skipper and Great Southern White: Conduct surveys to determine current distribution and abundance for inclusion in the LNHP database.

Rails: Initiate intensive surveys to better understand population densities and distributions in coastal marsh habitats.

Terns: Continue with nesting surveys and initiate research that focuses on factors (predation, human disturbance, etc.) effecting overall population densities.

Whooping Crane: Continue to coordinate with USFWS and LSU to develop plans for reintroduction of species on the White Lake Wetlands Conservation Area.

Waterbirds: Continue to conduct rookery surveys to update the LNHP database.

Species Conservation Strategies:

1. Shorebirds, Wading Birds:
   - Provide public education regarding the importance of waterbird nesting colonies and shorebird feeding areas. Reduce the negative effects on these areas from recreational and other uses.
   - Work with landowners to implement management and conservation recommendations for waterbirds (especially rails) of SWG project T18 upon completion.
   - Coordinate with GCJV to implement recommendations of shorebird and wading bird conservation plans.
   - Disturbance and loss of nesting habitat are major threats to these species. Continue with protection and restoration efforts of coastal. Develop new and/or improve existing partnerships to achieve this goal.

2. Waterfowl:
   - Continue to encourage the creation/enhancement/maintenance of high-quality habitat across Louisiana.
   - Work with DU, DW, and USFWS to assuring that quality habitat, including refuge from hunting and other disturbance, is distributed across the landscape.
   - Encourage maintenance of rice agriculture and discourage conversion to crops with lower value to waterfowl.
   - Continue LDWF partnerships with DU, DW, USWFS, and state wildlife management agencies to conserve habitat on the northern breeding grounds.
3. Bald Eagle: Continue with long-term monitoring of active bald eagle nests, successful breeding pairs, and fledged eagles.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat						
Source of Threat	Altered Composition/ Structure	Altered Water Quality	Habitat Destruction or Conversion	Habitat Disturbance	Herbivory	Modification of Water Levels; Changes in Natural Flow Patterns	Salinity Alteration
Channelization of rivers or streams	XXX	XXX	XXX			XXX	XXX
Construction of ditches, drainage or diversion systems		XXX	XXX			XXX	XXX
Development/ maintenance of pipelines, roads or utilities		XXX	XXX	XXX		XXX	XXX
Grazing practices	XXX	XXX	XXX	XXX			
Invasive/alien species	XXX	XXX	XXX		XXX		
Levee or dike construction	XXX	XXX	XXX	XXX		XXX	
Residential development			XXX	XXX			
Saltwater intrusion	XXX	XXX	XXX	XXX			XXX

Habitat Conservation Strategies:

1. Encourage the NRCS Plant Materials Center and other growers to produce a greater variety of plant species for the restoration of coastal habitats.

2. Work with COE and NRCS to develop better strategies for the placement of dredge materials as a restoration method for this habitat type.
3. Work with COE to influence water levels in the Atchafalaya Basin to benefit this habitat type.
4. Work with LCA, CWPPRA to broaden coastal restoration projects to include freshwater marsh.
5. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.

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19. Hardwood Flatwoods

Rarity Rank: S2S3/G2G3
Synonyms: Willow Oak Flats, Pin Oak Flats
Ecological Systems:
CES203.548 West Gulf Coastal Plain Nonriverine Wet Hardwood Flatwoods
CES203.193 Lower Mississippi River Flatwoods
CES203.557 East Gulf Coastal Plain Southern Loblolly-Hardwood Flatwood
CES203.278 West Gulf Coastal Plain Pine-Hardwood Flatwoods

General Description:

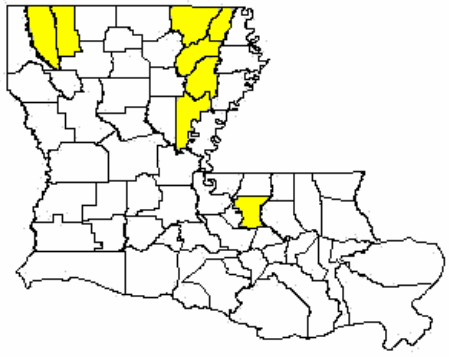
(Note: Wet hardwood flatwoods and mesic hardwood flatwoods are described as two distinct communities in the LNHP community classification system but are being treated together here due to similarities in the two habitat types.)

Wet hardwood flatwoods occur on hydric soils and are isolated and not usually affected by overbank flooding of a drainage. They occur on poorly drained flats and depressions. Mesic hardwood flatwoods occur on non-hydric, better drained soils on higher topographic positions than wet hardwood flatwoods, such as on low ridges and knolls. Wet hardwood flatwoods occur on Pleistocene Red River Channels in northwest Louisiana and on Pleistocene Valley Train Sediments on Macon Ridge in the northeast part of the state. Wet hardwood flatwoods historically occurred as primary habitat in East Baton Rouge Parish (Smith 1999). Soils are poorly drained silt loams to clays. On Macon Ridge the principal soil series that support this community are Calhoun and Gilbert silt loams. Occurrences in the Red River Valley are found on the Acadia series. Currently all known occurrences of mesic hardwood flatwoods are on Macon Ridge in West Carroll, Richland, Franklin and Morehouse Parishes in northeast Louisiana.

Dominant overstory trees of wet hardwood flatwoods include *Quercus phellos* (willow oak), *Fraxinus pennsylvanica* (green ash), *Carya ovata* (shagbark hickory), *Ulmus americana* (American elm), *Ulmus crassifolia* (cedar elm) and *Celtis laevigata* (hackberry). Other trees that are fairly frequent but not as common locally include *Quercus stellata* (post oak), *Q. pagoda* (cherrybark oak), *Liquidambar styraciflua* (sweetgum), *Carya myristiciformis* (nutmeg hickory) and *Gleditsia aquatica* (honeylocust). *Quercus lyrata* (overcup oak), *Quercus texana* (Nuttall oak), *Planera aquatica* (planertree), and *Forestiera acuminata* (swamp privet) dominate in wetter examples of this habitat. *Ulmus alata* (winged elm) and *U. crassifolia* are often abundant in the midstory. *Sabal minor* (palmetto) can be thick in the understory. Other important shrubs are *Ilex decidua* (deciduous holly) and *Styrax americana* (snowbell). Important herbaceous plants include *Cardamine bulbosa* (bulbous bitter cress), *Cynosciadium digitatum* (finger dog shade), *Tradescantia occidentalis* (small-flowered spiderwort), *Amsonia tabernaemontana* (bluestar), *Clematis crispa* (curl-flower), *Hymenocallis liriosome* (spider lily), *Carex intumescens* (common bladder caric sedge), *Trepocarpus aethusae* (muskweed), *Ranunculus pusillus* (low spearwort), and *Galium tinctorium* (dye bedstraw). *Climacium* sp. (tree moss) is usually abundant on the forest floor.

Mesic hardwood flatwoods support greater floristic diversity than wet hardwood flatwoods. Overstory dominants include *Carya alba* (mockernut hickory), *Nyssa sylvatica* (blackgum), *Quercus alba* (white oak), *Q. pagoda* (cherrybark oak), *Q. nigra* (water oak), *Q. michauxii* (cow oak), and *Liquidambar styraciflua* (sweetgum). *Quercus shumardii* (Shumard oak) and *Q. falcata* (southern red oak) are fairly frequent but not usually abundant. Common midstory trees include *Cornus florida* (flowering dogwood), *Ostrya virginiana* (eastern hophornbeam), *Aralia spinosa* (Devil's walking stick), *Ulmus alata* (winged elm), *Sassafras albidum* (sassafras), and *Acer rubrum* (red maple). Important shrubs/small trees are *Vaccinium arboreum* (tree huckleberry), *V. virgatum* (large cluster blueberry), *Viburnum rufidulum* (rusty blackhaw), *Crataegus marshallii* (parsley hawthorn), *Aesculus pavia* (red buckeye), *Frangula caroliniana* (Carolina buckthorn), *Asimina triloba* (pawpaw), *Hypericum hypericoides* (St. Andrew's Cross), and *Euonymus americana* (strawberry bush). Although infrequent, *Hamamelis virginiana* (witch hazel) can be locally abundant. Important woody vines include *Toxicodendron radicans* (poison ivy), *Parthenocissus quinquefolia* (Virginia creeper), *Vitis rotundifolia* (muscadine), *V. aestivalis* (summer grape), and *Smilax smallii* (lance-leaf greenbrier). Poison ivy and Virginia creeper are usually thick on the ground and are well-represented by high climbing individuals. Common and characteristic herbaceous plants include *Chasmanthium laxum* var. *sessiliflorum* (woods oats), *Dichanthelium boscii* (panic grass), *Podophyllum peltatum* (mayapple), *Carex cherokeensis* (Cherokee caric sedge), *Elephantopus carolinianus* and *E. tomentosus* (elephant's foot), *Scleria oligantha* (littlehead nutsedge), *Aristolochia serpentaria* (Virginia Dutchman's pipe), *Botrychium virginianum* (rattlesnake fern), *Passiflora lutea* (yellow passionflower), *Dioscorea villosa* (wild yam), *Clitoria mariana* (Atlantic pigeonwings), *Sanicula canadensis* (sanicle), *Geum canadense* (white avens), *Galium circaezans* (wild licorice), *Agrimonia rostellata* (woodland agrimony), *Spigelia marilandica* (Indian pink), *Clematis virginiana* (virgin's bower), *Phryma leptostachya* (lopseed), *Ruellia caroliniensis* (wild petunia), and *Smallanthus uvedalia* (bear's foot).

Current Extent and Status:



Most known occurrences of hardwood flatwoods are on the Macon Ridge in northeast Louisiana. The habitat is rare and threatened where it occurs in Bossier and Webster Parishes. A small amount of acreage of this habitat is captured by Bodcau WMA in Bossier Parish. The Louisiana Army Ammunition Plant in southern Bossier and Webster Parishes supports a high quality 69 acre hardwood flatwoods (McInnis and Martin 1995). In addition to East Baton Rouge, hardwood flatwoods may have been present in adjacent parishes of East Feliciana and Livingston. Hardwood flatwoods represent a gap in our knowledge. Research is needed to determine more accurately its former extent in Louisiana and to identify and characterize remnants of this habitat type.

HARDWOOD FLATWOODS SPECIES OF CONSERVATION CONCERN (17)		
AMPHIBIANS	Yellow-throated Vireo	Southeastern Myotis
Southern Dusky Salamander	Northern Parula	Louisiana Black Bear
	Swainson's Warbler	Long-tailed Weasel
BIRDS	Kentucky Warbler	Eastern Spotted Skunk
American Woodcock	Painted Bunting	
Yellow-billed Cuckoo	Orchard Oriole	**REPTILES**
Chuck-Will's-Widow		Timber Rattlesnake
Wood Thrush	**MAMMALS**	
	Southeastern Shrew	

Priority Species Research and Survey Needs:

Songbirds:

- Continue to support research on silviculture/land management practices and their effects on all songbird species.
- Develop long-term monitoring projects that focus on abundances and reproductive success (with emphasis on species of conservation concern) in this habitat type through the establishment of MAPS stations and BBS routes.

Chuck-Will's-Widow: Research is needed to better understand the population dynamics of this species. Studies should focus on distribution patterns, habitat availability and use, nesting success, and territory size requirements. Implementation of night-time surveys along with sighting reports by foresters, birders, etc. are needed to augment sparse BBS records.

Lousiana Black Bear: Continue research on its ecology and support repatriation efforts.

Eastern Spotted Skunk: Considered critically imperiled in Louisiana, intensive surveys needed to update occurrence records and abundance for inclusion in the LNHP database.

Southeastern Shrew: Considered imperiled in Louisiana. Together with Arkansas and Missouri, Louisiana represents the western edge of its range. Intensive surveys needed to update occurrence records and abundance for inclusion in LNHP database.

Document the habitat relationships of species of conservation concern and how dependent they are upon hardwood flatwoods, relative to other habitat types.

Determine the microhabitat preferences and requirements of species occupying hardwood flatwoods to understand how these species are utilizing the habitat and to determine management needs.

Species Conservation Strategies:

1. Identify IBA's or potential IBA's and partner with BRAS, OAS, and the NAS to implement conservation recommendations from SWG project T27 upon completion.

2. Chuck-Will's-Widow: Work with federal agencies and bird conservation organizations to produce technical pamphlets highlighting the habitat and management requirements of this species and make them available to landowners.
3. Louisiana Black Bear: Partner with the BBCC, USFWS and continue to support the implementation of recovery efforts for this species.
4. Timber Rattlesnake: Naturally low-occurring population levels and persecution make persistence in isolated forest blocks untenable. Prohibit killing of timber rattlesnakes and retain connectivity of flatwoods.
5. Promote use of appropriate silvicultural techniques to restore/manage hardwoods flatwoods for wildlife (include importance of tree species diversity, den trees for birds and mammals, leaf litter, etc).
6. Promote snag retention during logging operations to increase the numbers available for cavity-nesting wildlife species. Efforts need to be made to maintain sufficient levels of woody debris in stands for reptiles, amphibians and small mammals.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat			
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Conversion to agriculture or other forest types		XXX		XXX
Incompatible forestry practices	XXX		XXX	
Invasive/alien species	XXX			
Residential development		XXX	XXX	XXX

Habitat Conservation Strategies:

1. Support additional research on the extent of this habitat type, its ecological characteristics, and its classification.
2. Map remnants of this habitat type to aid in establishing priority sites for acquisition and conservation.
3. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.
4. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamplets and the LDWF website.

5. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.

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20. Intermediate Marsh

Rarity Rank: S3S4/G4
Synonyms: Oligohaline Marsh
Ecological Systems:
CES203.467 Gulf Coast Chenier Plain Fresh and Oligohaline Tidal Marsh
CES203.470 Mississippi Delta Fresh and Oligohaline Tidal Marsh

General Description:

This natural community lies between brackish marsh and freshwater marsh, although it infrequently may be adjacent to the Gulf. Intermediate marsh has an irregular tidal regime, is oligohaline (salinity of 3 to 10 ppt), and is dominated by narrow-leaved, persistent species. Small pools or ponds may be scattered. Plant diversity and soil organic matter content is higher than in brackish marsh. This marsh is characterized by a diversity of species, many of which are found in freshwater marsh and some of which are found in brackish marsh. Chabreck (1972) reported 55 plant species in intermediate marsh versus only 17 different species in salt marsh. It is often dominated by *Spartina patens* (wire grass). Other characteristic species include *Phragmites communis* (roseau cane), *Sagittaria lancifolia* (= *S. falcata*; bulltongue), *Bacopa monnieri* (coastal water hyssop), *Eleocharis* spp. (spikesedge), *Scirpus olneyi* (three-cornered grass), *S. californicus* (giant bulrush), *S. americnaus* (common threesquare), *Vigna luteola* (deer pea), *Paspalum vaginatum* (seashore paspalum), *Panicum virgatum* (switch grass), *Leptochloa fascicularis* (bearded sprangletop), *Pluchea camphorata* (camphor-weed), *Echinonchloa walteri* (walter millet), *Cyperus odoratus* (fragrant flatsedge), *Alternanthora philoxeroides* (alligator weed), *Najas guadalupensis* (southern naiad), *Spartina cynosuroides* (big cordgrass), and *S. spartineae* (gulf cordgrass) (LNHP 1986-2004). Two other major autotrophic groups in intermediate marsh are epiphytic and benthic algae. intermediate marsh occupies the least acreage of any of the four marsh types. This marsh type is very important to many species of avian wildlife and supports large numbers of wintering waterfowl. It is also critical nursery habitat to larval marine organisms. Gradual changes in salinity conditions can cause this habitat to shift towards brackish marsh.

Current Extent and Status:

The acreage of intermediate marsh appears to be decreasing due to salt water intrusion, canal dredging, and commercial, industrial, and residential development. Presettlement acreage was estimated at 100,000 to 500,000 acres, but has been reduced by 50 to 75 % of this original extent (Smith 1993). The largest contiguous tracts of intermediate marsh occur in Cameron,

Vermilion, Terrebonne, and Lafourche Parishes (Hartley et al. 2000). In the Chenier Plain of southwestern Louisiana, Sabine NWR contains approximately 91,000 acres of intermediate to brackish marsh. Rockefeller Wildlife Refuge has a total of 76,000 acres with approximately one-fifth of its acreage in intermediate marsh. In the Deltaic Plain of southeastern Louisiana, LDWF lands with freshwater marsh habitat include Pointe-aux-Chenes WMA (35,000 total acres, the majority are in brackish marsh with some intermediate marsh), Pass-a-Loutre WMA at the terminus of the Mississippi River (115,000 total acres, the majority are canals and waterways with some fresh and intermediate marsh), Pearl River WMA (total 36,000 acres with approximately one-fourth in freshwater and intermediate marsh), Biloxi WMA (39,583 acres of intermediate and salt marsh), and Manchac WMA (total 8,300 acres, once cypress swamp but now converted to intermediate marsh). NWRs with intermediate marsh in the Deltaic Plain include Bayou Sauvage NWR (23,000 acres of fresh and intermediate marsh), and Big Branch NWR (total land area of 15,000 acres, intermediate marsh acreage unknown).

INTERMEDIATE MARSH SPECIES OF CONSERVATION CONCERN (31)		
BIRDS	Black Rail	Forster's Tern
Brown Pelican	Clapper Rail	Short-eared Owl
American Bittern	King Rail	Sedge Wren
Reddish Egret	Sandhill Crane	Loggerhead Shrike
Yellow-crowned Night-Heron	Whooping Crane	
Mottled Duck	Marbled Godwit	**BUTTERFLIES**
Northern Pintail	Dunlin	Neamathla Skipper
Canvasback	Short-billed Dowitcher	Dion Skipper
Redhead	Gull-billed Tern	Obscure Skipper
Lesser Scaup	Caspian Tern	Great Southern White
Bald Eagle	Common Tern	Western Pygmy-Blue
Northern Harrier		

Priority Species Research and Survey Needs:

Rails: Initiate intensive surveys to better understand population densities and distributions in coastal marsh habitats.

Terns: Continue with nesting surveys and initiate research that focuses on factors (predation, human disturbance, etc.) effecting overall population densities.

Brown Pelican: Continue long-term monitoring of nesting colonies.

Waterbirds: Continue to conduct rookery surveys to update the LNHP database.

Butterflies: Conduct surveys to determine current distribution and abundance of all butterfly species, especially species of conservation concern, for inclusion in the LNHP database.

Species Conservation Strategies:

1. Terns:
   - Disturbance and loss of nesting habitat are major threats to terns. Develop partnerships to strengthen the protection and restoration of barrier islands.
   - Develop a comprehensive survey methology to determine long term trends in population abundances.
2. Shorebirds, Wading Birds:
   - Provide public education regarding the importance of waterbird nesting colonies and shorebird feeding areas. Reduce the negative effects on these areas from recreational and other uses.
   - Work with landowners to implement management and conservation recommendations for waterbirds (especially rails) of SWG project T18 upon completion.
   - Coordinate with GCJV to implement recommendations of shorebird and wading bird conservation plans.
   - Disturbance and loss of nesting habitat are major threatsto these species. Continue to protect and restore coastal marshes. Develop new and/or improve existing partnerships to achieve this goal.
3. Waterfowl:
   - Continue to encourage the creation/enhancement/maintenance of high-quality habitat across Louisiana.
   - Work with DU, DW, and USFWS to assuring that quality habitat, including refuge from hunting and other disturbance, is distributed across the landscape.
   - Encourage maintenance of rice agriculture and discourage conversion to crops with lower value to waterfowl.
   - Continue LDWF partnerships with DU, DW, USWFS, and state wildlife management agencies to conserve habitat on the northern breeding grounds.
4. Continue to work with USFWS/LSU in efforts to reintroduce whooping crane to Louisiana.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat						
Source of Threat	Altered Composition/ Structure	Altered Water Quality	Habitat Destruction or Conversion	Habitat Disturbance	Herbivory	Modification of Water Levels; Changes in Natural Flow Patterns	Salinity Alteration
Channelization of rivers or streams	XXX	XXX	XXX			XXX	XXX
Construction of ditches, drainage or diversion systems		XXX	XXX			XXX	XXX
Development/ maintenance of pipelines, roads or utilities		XXX	XXX	XXX		XXX	XXX
Grazing practices	XXX	XXX	XXX	XXX			
Invasive/alien species	XXX	XXX	XXX		XXX		
Levee or dike construction	XXX	XXX	XXX	XXX		XXX	
Residential development			XXX	XXX			
Saltwater intrusion	XXX	XXX	XXX	XXX			XXX

Habitat Conservation Strategies:

1. Encourage the NRCS Plant Materials Center and other growers to produce a greater variety of plant species for the restoration of coastal habitats.
2. Work with COE and state agencies to insure water control structures provide the maximum benefit to intermediate marsh.
3. Work with landowners to develop alternatives to livestock production in this habitat.
4. Work with LCA, CWPPRA for protection and restoration of intermediate marsh.
5. Support NRCS and DNR efforts to stabilize shorelines and restore habitat.

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21. Live Oak Natural Levee Forest

Rarity Rank: S1S2/G2
Synonyms: Natural Levee Forest, Frontland Forest
Ecological Systems:
CES203.512 Lower Mississippi River Bottomland and Floodplain Forest

General Description:

This community occurs principally in southeastern Louisiana on natural levees or frontlands and on islands within marshes and swamps. It is similar in some respects to coastal live oak-hackberry forest in that both develop on natural ridges in the coastal zone and overstory dominants are comparable. *Quercus virginiana* (live oak) typically dominates the stand, but *Q. nigra* (water oak), *Ulmus americana* (American elm), *Celtis laevigata* (hackberry), *Acer rubrum* var. *drummondii* (Drummond red maple), and *Fraxinus pennsylvanica* (green ash) are usually prominent community members, and may be predominant in areas. Overstory associates may include *Q. pagoda* (cherrybark oak), *Q. texana* (Nuttall oak), *Gleditsia triacanthos* (honey locust), *Liquidambar syraciflua* (sweetgum), and *Acer negundo* (box-elder). *Nyssa aquatica* (tupelo gum) and *Taxodium distichum* (baldcypress) are often present in wet depressions or on edges. *Sabal minor* (dwarf palmetto) is usually the most conspicuous midstory and understory shrub, often attaining heights of up to 4 m, but a number of other shrubs may be present, including *Ilex decidua* (deciduous holly), *Crataegus viridis* (green hawthorn), *Cornus foemina* (swamp dogwood), *Planera aquatica* (water elm), *Morella cerifera* (wax myrtle), *Sambucus canadensis* (elderberry), and *Persea borbonia* (red bay). The herbaceous layer is often poorly developed, but may contain such species as *Tradescantia* spp. (spiderworts), *Solidago sempervirens* (seaside goldenrod), *Samolus verlandieri* (water-pimpernel), *Sanicula canadensis* (snakeroot), *Arisaema dracontium* (green dragon), *Nemophylla aphylla* (baby blue eyes), *Geum canadensis* (geum), *Hydrocotyle* spp. (penny-worts), *Eupatorium* spp. (thoroughworts), *Polygonum* spp. (smartweeds), *Polygonum virginica* (jumpseed), *Packera glabella* (=*Senecio glabellus)* (yellow-top), *Panicum* spp. (panic grasses), *Oplismenus hirtellus* (basket grass), and *Thelypteris* spp. (marsh ferns). Vines are usually prominent and include *Mikania scandens* (climbing hempvine), *Cocculus carolinianum* (Carolina moonseed), *Campsis radicans* (trumpet creeper), *Toxicodendron radicans* (poison ivy), *Berchemia scandens* (rattan vine), and *Smilax rotundifolia* (common greenbrier). Epiphytes are significant community members and include the highly conspicuous *Tillandsia usneoides* (Spanish moss), plus *Polypodium polypodioides* (resurrection fern), and *Phoradendron tomentosum* (mistle-

toe). Several introduced species have become serious invaders of this habitat, including *Lygodium japonicum* (Japanese climbing fern), *Triadica sebifera* (=*Sapium sebiferum)* (Chinese tallow tree), and *Lonicera japonica* (Japanese honeysuckle).

Current Extent and Status:

Louisiana's live oak natural levee forests occur in the Deltaic Plain of extreme southeastern parishes from Orleans and St. Bernard Parishes westward to St. Mary Parish. Since this forest type is found only on natural levees which are higher and drier than the surrounding bottomlands and marshes, they were the first areas to be cleared for agricultuire and residential development. Of the original 500,000 to 1,000,000 acres in Louisiana, currently only 10,000 to 50,000 acres remain, 1-5 % of presettlement extent. The majority of these remnant forests are altered and fragmented, and threats continue from residential development, roads and utility installation, overgrazing, coastal erosion and saltwater intrusion. The majority of natural levee forests are in private ownership. A portion is protected within Jean Lafitte National Historical Park and Bayou Sauvage NWR. There are also a few remnant strips on the Wisner, Pointe-aux-Chenes, and Salvador WMAs. One tract of 71 acres, owned by Plaquemines Parish, is part of the Louisiana Natural Areas Registry Program.

LIVE OAK NATURAL LEVEE FOREST SPECIES OF CONSERVATION CONCERN (16)		
BIRDS	Yellow-throated Vireo	Orchard Oriole
Yellow-crowned Night-Heron	Northern Parula	
Wood Stork	Prothonotary Warbler	**MAMMALS**
Bald Eagle	Swainson's Warbler	Long-tailed Weasel
American Woodcock	Kentucky Warbler	
Yellow-billed Cuckoo	Hooded Warbler	**REPTILES**
Wood Thrush	Painted Bunting	Timber Rattlesnake

Priority Species Research and Survey Needs:

Songbirds: Continued research is needed on silviculture/land management practices and their effects on all songbird species.

Long-tailed Weasel: Considered vulnerable in Louisiana. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Document the habitat relationships of species of conservation concern and how dependent they are upon live oak natural levee forest habitats, relative to other habitat types.

Determine the microhabitat preferences and requirements of species occupying live oak natural levee forests to understand how these species are utilizing the habitat to determine management needs.

Species Conservation Strategies:

1. Timber Rattlesnake: Naturally low-occurring population levels and persecution make their persistence in isolated forest blocks untenable. Prohibit killing timber rattlesnakes. Reduce vehicular travel where possible to avoid snade kills.
2. Swallow-tailed Kite: Implement conservation and management recommendations of SWG project T9 (Coulson 2004).
3. Bald Eagle: Continue with long-term monitoring of active bald eagle nests, successful breeding pairs, and fledged eagles.
4. Identify IBA's or potential IBA's and partner with BRAS, OAS, and the NAS to implement conservation recommendations from SWG project T27 upon completion.
5. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS endangered and threatened species recovery plans over the next 10 years.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat				
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Herbivory
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX	
Invasive/alien species	XXX				
Management of/for certain species					XXX
Recreational use/vehicles			XXX		
Residential development		XXX	XXX	XXX	
Saltwater intrusion	XXX	XXX			

Habitat Conservation Strategies:

1. Work with the legislature to develop tax incentives and conservation servitudes or leases for landowners to encourage conservation of this habitat type.

2. Partner with NGOs, private landowners, etc. to promote protection of live oak forests and continue to encourage landowners to enroll this habitat type in the Natural Areas Registry Program.
3. Work with COE and NRCS to develop strategies for the placement of dredge materials as a restoration method for this habitat type.
4. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamplets and the LDWF website.
5. Support NRCS and DNR efforts for shoreline stabilization and habitat restoration.
6. Work with LCA, CWPPRA to broaden the coastal restoration projects to include live oak forests.
7. Work with local parish planning commissions and DNR to change zoning classifications to reduce development within this habitat type.

References:

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22. Live Oak-Pine-Magnolia Forest

Rarity Rank: S2/G2G3
Synonyms: Maritime Forest, Maritime Mesophytic Forest
Ecological Systems: CES203.503 East Gulf Coastal Plain Maritime Forest

General Description:

This community is known in Louisiana from southern St. Tammany Parish, and occurs in a zone within 2 miles of Lake Pontchartrain where the Pleistocene prairie terrace meets the lake. Soils typically are sandy in nature. The community may exhibit site to site variation in species composition and physiognomy depending on soil moisture regime, age, fire history, relative exposure to salt spray, local relief, proximity to drains, and salt-water inundation during very high tides (such as those associated with hurricanes). A number of these factors are related to distance from the lake. The canopy structure of natural stands is believed to be more open than present-day stands. Overstory species include *Quercus virginiana* (live oak), *Pinus palustris* (longleaf pine), *Pinus elliottii* (slash pine), *Pinus taeda* (loblolly pine), and *Magnolia grandiflora* (southern magnolia). Significant canopy associates may include *Quercus nigra* (water oak), *Q. alba* (white oak), *Q. michauxii* (swamp white oak), *Q. laurifolia* (laurel oak), *Q. pagoda* (cherybark oak), *Liquidambar styraciflua* (sweetgum), *Fraxinus* spp. (ashes), *Acer rubrum* (red maple), *Magnolia virginiana* (sweet bay), *Liquidambar styraciflua* (sweetgum), *Celtis laevigata* (hackberry), and *Nyssa sylvatica* (black gum). Principal midstory and understory plants include *Sabal minor* (dwarf palmetto), *Ilex opaca* (American holly), *Ilex vomitoria* (yaupon), *Vaccinium* spp. (blueberries), *Osmanthus americanus* (devil-wood), *Carpinus caroliniana* (iron wood), *Ostrya virginiana* (hophornbeam), *Symplocos tinctoria* (sweetleaf), *Asimina parviflora* (dwarf pawpaw), *Oxydendrum arboreum* (sourwood), *Aralia spinosa* (devil's walking stick), *Persea borbonia* (red bay), *Rhus copallina* (winged sumac), *Morella cerifera* (wax myrtle), *Callicarpa americana* (french mulberry), *Sassafras albidum* (sassafras), *Thelypteris palustris* (southern marsh-fern), *Osmunda cinnamomea* (cinnamon fern), and *Lorinseria areolata* (net-veined chain-fern). Many vine species are present.

This natural community may in reality be a transitonal type between mesic Mixed Hardwood-Loblolly Forest and/or Beech-Magnolia Forest and more typical maritime forests that occur in coastal states east of Louisiana. Or it may be an artificial aggregation, with the original species complement disproportionately represented in today's forests. Further field inventories are needed to more fully understand and define this community. Fire, although uncommon, may play an important role in Live Oak-Pine-Magnolia Forest.

Current Extent and Status:

This community is extremely restricted in its occurrence in Louisiana, and is known only from St. Tammany Parish along the northshore of Lake Pontchartrain. Presettlement estimates of this habitat type are from 10,000 to 50,000 acres, but only 10 to 25 % of the original extent remains today. A small portion of this habitat is protected at Fontainebleau State Park. All other occurrences are under private ownership.

LIVE OAK – PINE – MAGNOLIA FOREST SPECIES OF CONSERVATION CONCERN (19)		
AMPHIBIANS	Swainson's Warbler	Southeastern Myotis
Oak Toad	Kentucky Warbler	Long-tailed Weasel
	Hooded Warbler	
BIRDS	Field Sparrow	**REPTILES**
Yellow-billed Cuckoo	Rusty Blackbird	Eastern Glass Lizard
Chuck-Will's-Widow	Orchard Oriole	Pine Woods Littersnake
Wood Thrush		Southeastern Crowned Snake
Yellow-throated Vireo	**MAMMALS**	Harlequin Coralsnake
Northern Parula	Southeastern Shrew	

Priority Species Research and Survey Needs:

Chuck-Will's-Widow: Research is needed to better understand the population dynamics of this species. Studies should focus on distribution patterns, habitat availability and use, nesting success, and territory size requirements. Implementation of night-time surveys along with sighting reports by foresters, birders, etc. are needed to augment sparse BBS records.

Southeastern Shrew: Considered imperiled in Louisiana. Together with Arkansas and Missouri, Louisiana represents the western edge of its range. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Long-tailed Weasel: Considered vulnerable in LA. Intensive surveys needed to update occurrence records and abundance for inclusion in LNHP database.

Southeastern Crowned Snake: Recent records are from ridges along the north shore of Lake Pontchartrain, but recent surveys have failed to detect crowned snakes. Initiate pitfall trap surveys at Fontainebleau State Park and Big Branch NWR are needed to assess potential occurrence in developing areas.

Document the habitat relationships of species of conservation concern and how dependent they are upon live oak- pine-magnolia forest habitats, relative to other habitat types.

Determine the microhabitat preferences and requirements of species occupying live oak – pine-magnolia forest to understand how these species are utilizing the habitat to determine management needs.

Species Conservation Strategies:

1. Chuck-Will's-Widow: Work with federal agencies and bird conservation organizations to produce technical pamphlets highlighting the habitat and management requirements of this species and make them available to landowners.
2. Songbirds: Continue to monitor songbird abundance and reproductive success (with emphasis on species of conservation concern) in this habitat through the establishment of MAPS stations.
3. Promote snag retention during logging operations to increase their numbers for cavity-nesting species. Efforts need to be made to maintain sufficient levels of woody debris in stands for reptiles, amphibians and small mammals.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat			
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Conversion to agriculture or other forest types		XXX		XXX
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX
Incompatible forestry practices	XXX		XXX	
Invasive/alien species	XXX		XXX	
Residential development		XXX	XXX	XXX

Habitat Conservation Strategies:

1. Conduct inventories to determine the amount and extent of all remaining undeveloped acres of this habitat type.
2. Support research to identify historic fire regimes and general natural community characteristics of this habitat.

3. Partner with NGOs, OSP, private landowners, etc. to initiate restoration and preservation efforts of live oak – pine – magnolia forests and continue to encourage landowners to enroll this habitat type in the Natural Areas Registry Program.

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23. Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest

Rarity Rank: Mixed Hardwood-Loblolly Pine Forest- S4/G4
Hardwood Slope Forest - S3S4/G4

Synonyms: Mixed Pine Hardwood, Loblolly Pine-Hardwood, Beech-Magnolia Forest, Mixed Hardwood Forest, Hammock, Mixed Mesic Hardwood Forest

Ecological Systems:
CES203.476 East Gulf Coastal Plain Southern Mesic Slope Forest
CES203.280 West Gulf Coastal Plain Mesic Hardwood Forest
CES203.378 West Gulf Coastal Plain Pine-Hardwood Forest

General Description:

(Note: Hardwood slope forests and mixed hardwood - loblolly pine forests are described as distinct communities in the LNHP Natural Communities of Louisiana. They are considered together here due to their floristic similarity and similarity in management needs.)

These two communities can be similar in species composition but they differ in topographic position and soil moisture, with hardwood slope forests being more mesic. Both communities are more or less evenly distributed in the uplands statewide.

Hardwood slope forests occur on slopes (often steep) rising out of small (or larger) stream floodplains. Mixed hardwood - loblolly pine forests are found upslope and, depending on moisture regime, on low ridge tops. *Pinus taeda* (loblolly pine) may be present but infrequent in a hardwood slope forest, but comprises 20 percent or more of the overstory, associated with various hardwood species, in a mixed hardwood - loblolly pine forest.

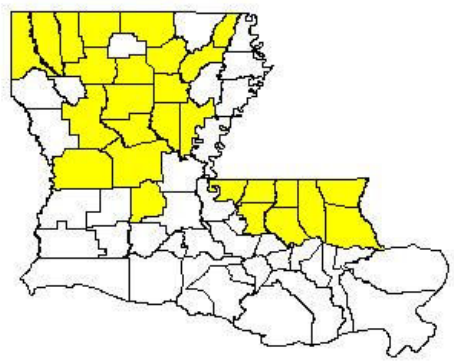
Without fire, mixed hardwood-loblolly pine forest succession is toward hardwood dominance. Given the available pine needle fuel, regular fire was a process maintaining a significant pine component. Other types of disturbances may also allow loblolly pine to remain a component of the forest. Fire may have occurred very rarely in hardwood slope forests, but is not a process required to maintain this community. In hardwood slope forests, *Fagus grandifolia* (beech) and *Magnolia grandiflora* (southern magnolia) are typically canopy dominants. However, in north Louisiana, southern magnolia is often infrequent or absent. Other primary overstory species include *Quercus alba* (white oak), *Q. shumardii* (shumard oak), *Q. michauxii* (swamp white oak), *Q. nigra* (water oak), *Q. laurifolia* (laurel oak), *Q. velutina* (black oak), *Magnolia acuminata* (cucumber tree), *M. macrophylla* (big-leaf magnolia), *M. pyramidata* (pyramid magnolia, rarely),

Liriodendron tulipifera (tulip tree), *Liquidambar styraciflua* (sweetgum), *Carya tomentosa* (mockernut hickory), *C. cordiformis* (bitternut hickory), and *C. glabra* (pignut hickory). *Pinus taeda* may be present sporadically in the overstory, and *Pinus glabra* (spruce pine) is an occassional associate in the Florida Parishes. Significant midstory and understory associates are *Oyxdendrum arboreum* (sourwood), *Halesia diptera* (silverbell), *Styrax grandifolia* (bigleaf snowbell), *Cornus florida* (flowering dogwood), *Symplocos tinctoria* (sweetleaf), *Prunus caroliniana* (cherry-laurel), *Stewartia malacodendron* (silky camelia), *Amelanchier arborea* (downy service-berry), *Ilex ambigua* (holly), *Illicium floridanum* (starbush, southeastern Louisiana), *Carpinus caroliniana* (ironwood), *Ostrya virginiana* (eastern hophornbeam), *Vaccinium arboreum* (winter huckleberry), *V. elliottii* (Elliott's blueberry), and *Erythrina herbacea* (red coral bean). Herbaceous species include *Hexastylis arifolia* (wild ginger, southeast Louisiana), *Trillium* spp. (wake-robbins), *Polygonatum biflorum* (smooth solomon's seal), *Uvularia perfoliatum* (bellwort), *Tipularia discolor* (crane-fly orchid), *Viola* spp. (violets), *Spigelia marilandica* (Indian pink), *Podophyllum peltatum* (may-apple), *Sanicula* spp. (snakeroots), *Polymnia uvedalia* (bear-paw), *Chamaelirium luteum* (devil's-bit), *Lilium michauxii* (Carolina lily), *Arisaema* spp. (jack-in-the-pulpits), *Prenanthes altissima* (tall rattlesnake root), *Polystichum acrostichoides* (Christmas fern), and *Phegopteris hexagonoptera* (broad beech-fern). On salt domes in the coastal zone, this natural community lacks beech, but includes *Q. virginiana* (live oak), various elms (*Ulmus* spp.), and other species not typical of hardwood slope forests above the coastal zone.

In mixed hardwood - loblolly pine forests *Pinus taeda* comprises at least 20 percent of the overstory. On moist sites *Liquidambar styraciflua* (sweetgum), *Fagus grandifolia, Quercus nigra*, *Q. pagoda* (cherrybark oak), *Q. michauxii*, *Q. alba*, *Liriodendron tulipifera* (yellow poplar), *Ulmus americana* (American elm), *Magnolia grandiflora*, *Acer rubrum*, and *Carya glabra* are important hardwood components. On dryer upland sites protected from fire, overstory dominants in addition to loblolly are *Quercus falcata* (southern red oak), *Q. stellata* (post oak), *Q. nigra*, *Q. marilandica* (blackjack oak), *Nyssa sylvatica* (black gum) and *Carya tomentosa*. This community occurs infrequently on sandy, xeric sites and here, *Q. incana* (bluejack oak) and *Q. hemispherica* (upland laurel oak) are frequent associates. Shrubs and understory species may include, depending on moisture regime, *Ilex glabra* (gallberry), *Callicarpa americana* (french mulberry), *Cornus florida*, *Crataegus* spp. (hawthorns), *Oxydendrum arboreum* (sourwood), *Vaccinium elliottii*, *V. arboreum*, *Rhus copallina* (winged sumac), *Toxicodendron radicans* (poison ivy), *Morella cerifera* (wax myrtle), *Ilex vomitoria* (yaupon), *Rubus* spp. (blackberries), *I. decidua* (deciduous holly), *Malus angustifolia* (crab apple), and *Gelsemium sempervirens* (yellow jessamine), *Mitchella repens* (partridge-berry), and *Viola* spp. (violets).

Current Extent and Status:

As indicated by rarity ranks for these two communities this habitat is not as imperilled as many others. A mixed loblolly pine-hardwood type is expanding in some cases into uplands due to fire suppression. However, older, more natural examples of this habitat are threatened by conversion to pine plantations (Martin and Smith 1993, Grace



and Smith 1995, Williams and Smith 1995). Natural occurrences are scattered mainly in the WGCP of central Louisiana and EGCP in the eastern Florida Parishes. There are a few occurences known on Macon Ridge in the MRAP and it was probably much more common there historically. A number of occurrences are on conservation lands such as Kisatchie National Forest. The hardwood slope forest community is estimated to have occupied 100,000 to 500,000 acres historically and of that an estimated 25 to 50 % still remains (Smith 1993). Mixed hardwood-loblolly pine forest is estimated to have been more extensive, occuppying 500,000 to 1,000,000 acres historically with the same percentage thought to remain today (Smith 1993).

MIXED HARDWOOD - LOBLOLLY PINE/HARDWOOD SLOPE FOREST SPECIES OF CONSERVATION CONCERN (45)		
AMPHIBIANS	Northern Parula	**MAMMALS**
Louisiana Slimy Salamander	Prairie Warbler	Southeastern Shrew
Southern Red-backed Salamander	Worm-eating Warbler	Southeastern Myotis
Southern Red Salamander	Swainson's Warbler	Northern Myotis
Oak Toad	Louisiana Waterthrush	Silver-haired Bat
Barking Treefrog	Kentucky Warbler	Big Brown Bat
Eastern Spadefoot	Hooded Warbler	Louisiana Black Bear
	Field Sparrow	Long-tailed Weasel
BIRDS	Orchard Oriole	Eastern Spotted Skunk
Bald Eagle		
American Woodcock	**BUTTERFLIES**	**REPTILES**
Yellow-billed Cuckoo	Wild Indigo Duskywing	Eastern Glass Lizard
Chuck-Will's-Widow	Pepper and Salt Skipper	Western Worm Snake
Brown-headed Nuthatch	Yucca Giant Skipper	Northern Scarlet Snake
Wood Thrush	Falcate Orangetip	Mole Kingsnake
Bell's Vireo	Harvester	Scarlet Kingsnake
Yellow-throated Vireo	Little Metalmark	Pine Woods Littersnake
		Harlequin Coral Snake
		Timber Rattlesnake

Priority Species Research and Survey Needs:

Songbirds:

- Continue to support research on silviculture/land management practices and their effects on all songbird species.
- Develop long-term monitoring projects that focus on abundances and reproductive success (with emphasis on species of conservation concern) in this habitat type through the establishment of MAPS stations and BBS routes.

Butterflies: Conduct surveys to determine current distribution and abundance of all butterfly species, especially species of conservation concern, for inclusion in the LNHP database.

Chuck-Will's-Widow: Research is needed to better understand population dynamics of this species. Studies should focus on distribution patterns, habitat availability and use, nesting success, and territory size requirements. Implementation of night-time surveys along with sighting reports by foresters, birders, etc. are needed to augment spares BBS records.

Bats:

- Northern Myotis: This species was first documented in Louisiana in 2003 (Crnkovic 2003). Conduct intensive surveys to determine its current status in Louisiana and to evaluate the importance of bridges as roost sites (Leberg 2004).
- Develop projects that target species of conservation concern and focus on their distribution, abundance, and ecological needs in this habitat type (Lacki et al. 2001).
- Research the genetic identities of different Myotis species in the state (Leberg 2004).

Eastern Spotted Skunk: Considered critically imperiled in Louisiana. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Long-tailed Weasel: Considered vulnerable in Louisiana. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Ringtail: Louisiana represents the eastern edge of its range. Intensive surveys are needed to determine its current status in Louisiana.

Determine the microhabitat preferences and requirements of species utilizing mixed hardwood-loblolly pine/hardwood slope forest to understand how these species are utilizing the habitat to develop management guidelines for these species.

Species Conservation Strategies:

1. Louisiana Slimy Salamander, Southern Red-backed Salamander, Western Worm Snake: This guild of species occurs in isolated slope sites, and appears to be intolerant of habitat alteration. Encourage timber companies to designate no-cut zones (especially on slopes, slope crests, and riparian borders).
2. Songbirds:
   - Continue to encourage landowners to maintain areas in early successional stage to benefit bird species which depend on this habitat.
   - Work with NRCS, USFWS, USFS to develop and distribute technical pamphlets which contain information about the importance of early successional habitat for species of conservation concern.
   - Continue to monitor songbird abundance and reproductive success (with emphasis on species of conservation concern) in this habitat through the establishment of MAPS stations.

3. Chuck-Will's-Widow: Work with federal agencies and bird conservation organizations to produce technical pamphlets highlighting the habitat and management requirements of this species and make available to landowners.
4. Bald Eagle: Continue with long-term monitoring of active bald eagle nests, successful breeding pairs, and fledged eagles.
5. Louisiana Black Bear: Partner with the BBCC, USFWS and continue to support the implementation of recovery efforts for this species.
6. Establish monitoring systems and protocols for target bats species and other mammal species associated with mixed hardwood-loblolly pine/hardwood slope forest.
7. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat			
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Conversion to agriculture or other forest types		XXX		XXX
Development/maintenance of pipelines, roads or utilities			XXX	XXX
Fire suppression	XXX			
Incompatible forestry practices	XXX		XXX	XXX
Invasive/alien species	XXX			
Recreational use/vehicles			XXX	
Residential development		XXX	XXX	XXX

Habitat Conservation Strategies:

1. Develop best management practices for restoration of this habitat type including appropriate fire regimes and herbicide uses.
2. Continue to encourage landowners to implement BMPs and adopt SFI standards in the management of this habitat type.
3. Encourage use of existing NRCS, USFWS programs in providing cost share incentives to landowners for invasive species control.

4. Develop partnerships with federal and state agencies, NGO's and others to identify potential parcels of this habitat type for acquisition and conservation.
5. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
6. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.

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24. Saline Prairie

Rarity Rank: S1/G1G2
Synonyms: Barrens, Salt Barrens, Slicks
Ecological Systems: CES203.291 West Gulf Coastal Plain Saline Glade

General Description:

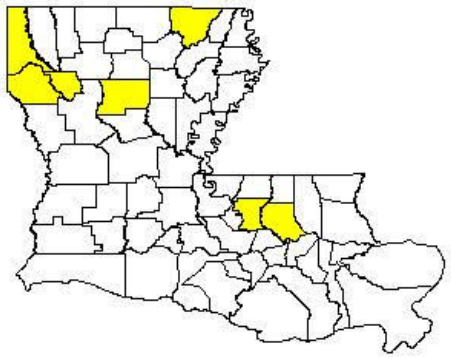
Saline prairie is a natural, mostly treeless natural community currently known from a few scattered sites in central and northwestern Louisiana. Typically only a few acres in size, they may be wet, mesic or dry prairies. The wet variants arise on low flat terraces subject to regular flooding adjacent to or near small to intermediate streams. Wet saline prairies usually grade upslope into mesic or dry saline prairies. In aspect, these prairies are usually a mosaic of variably dense herbaceous vegetation (thick to thin), with interspersed bare soil areas ("slicks"). Shrubs are intermixed to a greater or lesser degree, and may in places form saline shrub thickets.

The soils for all saline prairies have high levels of exchangeable sodium and (at times) magnesium in the subsoil and near the surface horizons that have created extreme conditions for plant growth. Such conditions include relatively high alkalinity, very poor movement of water and air in the soil, resistance to wetting that can induce droughty conditions, resistance to drying once saturated, and sodic horizon in the subsoil that acts much like a dense claypan and is very resistant to root penetration. The soil, naturally low in fertility, contains relatively high levels of certain water-soluble salts that are injurious to plants and may produce alkali chlorosis and mortality. The principal soils supporting the community in the UWGCP and EGCP are the Bonn and Lafe series. Occurrences on the LWGCP are on Brimstone soils. The plant community therefore includes many halophytic (salt tolerant) forbs, grasses and grass-like plants.

Characteristic plants include *Aristida* spp. (three-awn grasses), *Aster subulatus*, *Atriplex pentandra* (orach), *Bacopa monnieri* (water hyssop), *B. rotundifolia*, *Carex glaucescens* (sedge), *Chasmanthium latifolium* (spikegrass), *Diodia teres* (poorjoe), *Distichlis spicata* (alkali grass), *Eleocharis* spp. (spikerush), *Fimbristylis castanea*, *Geocarpon minimum* (earthfruit, federally-listed as threatened, image above), *Heliotropium curassivicum* (heliotropes), *Hibiscus moscheutos* ssp. *lasiocarpus* (hibiscus), *Iris brevicaulis* (lamance iris), *Iva angustifolia* (marsh elder), *Juncus* spp. (rushes), *Ludwigia* spp. (primrose), *Lythrum lineare* (loosestrife), *Panicum virgatum* (switchgrass), *Phyla nodiflora* (frog-fruit), *Pluchea camphorata* (stinkweed), *Polygonum*

aviculare (knotweed), *Proserpinaca pectinata* (mermaid-weed), *Rhynchospora corniculata* (beakrush), *Schizachyrium scoparium* (little bluestem), *Solidago sempervirens* (seaside goldenrod), *Spartina pectinata* (prairie cordgrass), *Tradescantia occidentalis* (spiderwort), and *Tridens strictus* (sandgrass). Characteristic tree, shrub and vine species (nearby or very scattered in prairie) include: *Ampelopsis arborea* (peppervine), *Baccharis hamilifolia* (saltbush), *Berchemia scandens* (rattan vine), *Cephalanthus occidentalis* (buttonbush), *Crataegus berberifolia* (barberry hawthorn), *C. brachyacantha* (blueberry hawthorn), *C. virdis* (green hawthorn), *Fraxinus caroliniana* (Carolina ash), *Morella cerifera* (wax myrtle), *Pinus taeda* (loblolly pine), *Quercus lyrata* (overcup oak), *Q. nigra* (water oak), *Q. similis* (delta post oak), *Q. phellos* (willow oak), and *Ulmus crassifolia* (cedar elm).

Current Extent and Status:



Saline prairies are widely scattered in Louisiana. There are only three known intact saline prairies in the UWGCP. Two of them are in Red River Parish and one is in southern Caddo Parish. The Red River saline prairies are on industrial forest land and are being protected. The Caddo prairie is on non-industrial private land and LNHP is just beginning to work with the landowner toward conservation of the site. There are several other saline prairies in Caddo and Desoto parishes that require a field survey to determine their status. There is one named saline prairie in Morehouse Parish called Prairie de Butte that is now completely extirpated. There are patches of Lafe series soil near this site with some characteritic flora but no known intact prairies. In the Lower West Gulf Coastal Plain there are several high quality saline prairies in southeast Winn Parish. Two of these prairies support the federally-listed *Geocarpon minimum* (earth fruit). Saline prairies are suspected to occur in adjacent Caldwell Parish. Saline prairies were histoically known from East Baton Rouge Parish and Livingston Parishes and these prairies have now been extirpated (Smith 1999). Saline Prairies were not extensive in presettlement times. The estimated presettlement acreage for Saline Prairie is less than 2,000 with an estimated 10 to 25 % remaining (Smith 1993).

SALINE PRAIRIE SPECIES OF CONSERVATION CONCERN (6)		
BIRDS	**MAMMALS**	**REPTILES**
American Woodcock	Hispid Pocket Mouse	Western Slender Glass Lizard
Field Sparrow	Eastern Harvest Mouse	
Grasshopper Sparrow		

Priority Species Research and Survey Needs:

Field Sparrow and Grasshopper Sparrow: Survey's are needed to determine breeding (Field Sparrow) and wintering population abundances and to assess the amount and quality of available habitat statewide.

Eastern Harvest Mouse: Considered vulnerable in Louisiana. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Hispid Pocket Mouse: Louisiana represents the eastern edge of its range. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Western Slender Glass Lizard: Occurrence in saline prairies is likely but imperfectly known. Glass lizards are declining over much of their range, regardless of habitat alteration. Determine the extent of any correlations between glass lizard occurrence and Saline Prairies.

Determine the microhabitat preferences and requirements of species occurring in saline prairies to understand how these species are utilizing the habitat to develop management recommendations.

Species Conservation Strategies:

1. Songbirds:
   - Continue to encourage landowners to maintain areas in an early successional stage to benefit bird species which depend on this habitat.
   - Work with NRCS, USFWS, USFS to develop and distribute technical pamphlets which contain information about the importance of early successional habitat for species of conservation concern.
   - Continue to monitor songbird abundance and reproductive success (with emphasis on species of conservation concern) in this habitat through the establishment of MAPS stations.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat			
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Soil Erosion
Development/maintenance of pipelines, roads or utilities		XXX	XXX	
Grazing practices	XXX	XXX		
Incompatible forestry practices	XXX	XXX	XXX	XXX
Invasive/alien species	XXX		XXX	XXX
Oil or gas drilling		XXX		
Recreational use/vehicles	XXX	XXX	XXX	XXX

Habitat Conservation Strategies:

1. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamplets and the LDWF website.
2. Conduct surveys to determine the current extent and condition of this habitat type.
3. Develop management plans/recommendations for this habitat type.
4. Prepare GIS layer of soil type locations where prairies might occur and provide this information to the timber industry.
5. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
6. Provide management guidelines for control of invasive species within this habitat type.
7. Support research to understand basic ecosystem characteristics and processes and to develop methods to reduce soil erosion.
8. Develop strategies to address damage from feral hogs within this habitat type.
9. Work with hunting clubs and other landowners to restrict ATV use to existing trails to prevent degradation of this habitat type.

References:

LNHP. 1986-2004. The natural communities of Louisiana. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

NATURESERVE. 2005. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.2. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: March 8, 2005).

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———. 1996. The rare and sensitive natural wetland communities of interior Louisiana. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

———. 1999. Historic vegetation of the Florida Parishes, by parish. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

25. Salt Dome Hardwood Forest

Rarity Rank: S1/G1
Synonyms: None
Ecological Systems: CES203.466 West Gulf Coastal Plain Chenier and Upper Texas Coastal Fringe Forest and Woodland

General Description:

This is an upland forest type on loess-derived silt loams of salt domes in coastal Louisiana. Area of occurrence is very restricted. The canopy is dominated by *Quercus virginiana* (live oak), *Magnolia grandiflora* (Southern magnolia), *Q. pagoda* (cherrybark oak), *Ulmus americana* (American elm), *Celtis laevigata* (hackberry), *Liquidambar styraciflua* (sweetgum), *Tilia americana var. caroliniana* (basswood), *Q. nigra* (water oak), and *Carya glabra* (pignut hickory). The epiphyte *Pleopeltis polypodioides* (resurrection fern) is quite common in canopy trees. The patchy to dense understory consists of *Prunus caroliniana* (cherrylaurel), *Ilex vomitoria* (yaupon), S*abal minor* (dwarf palmetto), *Callicarpa americana* (french mulberry), *Aesculus pavia* (red buckeye), and *Smilax rotundifolia* (common greenbriar). The herb layer is typically sparse and includes *Oplismenus hirtellus* ssp. *setarius* (bristle basketgrass), *Sanicula canadensis* (black snakeroot), *Malvaviscus arboreus* var. *drummondii* (wax mallow), and *Elephantopus carolinianus* (Carolina elephant's foot). Common woody vines include *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (poison ivy), *Vitis rotundifolia* (muscadine grape), *Rubus* spp. (blackberry), *Ampelopsis arborea* (peppervine), and *Smilax bona-nox* (saw greenbriar).

Current Extent and Status:

The five salt domes, or "islands" of Louisiana are Avery, Belle Isle, Cote Blanche, Jefferson, and Weeks. Currently, Cote Blanche and Weeks support high quality forest. The condition of Belle Isle is unknown but it is suspected that there is some good habitat there. There is a 350 acre tract on Jefferson Island that is part of LDWF's Louisiana Natural Areas Registry Program (Live Oak Garden Natural Area). However the current condition of the forest on this site is unknown. Avery Island, while quite large, supports very

little natural forest as much has been cleared and the remainder is disturbed, overrun with exotics, and affected by severe erosion. An assessment of size and quality of remaining salt dome hardwood forest is warranted.

SALT DOME HARDWOOD FOREST SPECIES OF CONSERVATION CONCERN (13)		
BIRDS	Painted Bunting	**MAMMALS**
Bald Eagle	Orchard Oriole	Southeastern Myotis
American Woodcock		Louisiana Black Bear
Yellow-billed Cuckoo	**BUTTERFLIES**	Eastern Spotted Skunk
Northern Parula	Celia's Roadside Skipper	
Prothonotary Warbler	Wild Indigo Duskywing	**REPTILES**
		Timber Rattlesnake

Priority Species Research and Survey Needs:

Neotropical Migrant Birds: Institute long-term surveys to monitor neotropical bird use of this habitat during migration.

Butterflies: Conduct surveys to determine the current distribution and abundance of all butterfly species, especially species of conservation concern, for inclusion in the LNHP database.

Determine the microhabitat preferences and requirements of species occuring in salt dome hardwood forests to understand how these species are utilizing the habitat to develop management recommendations.

Species Conservation Strategies:

1. Louisiana Black Bear: Partner with the BBCC, USFWS and continue to support the implementation of recovery efforts for this species.
2. Timber Rattlesnake: Naturally low-occurring population levels and persecution makes their persistence on isolated domes untenable. Prohibit killing or removal of timber rattlesnakes from salt domes.
3. Songbirds: Develop a monitoring program (i.e., MAPS) to assess relative abundances of songbird species in this habitat.
4. Promote the benefits of bat colonies and roost sites and develop partnerships with landowners to encourage protection of valauable sites.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat				
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Toxins/ Contaminants
Commercial/industrial development		XXX			
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX	
Invasive/alien species	XXX				
Mining practices		XXX			XXX

Habitat Conservation Strategies:

1. Partner with state and federal agencies, NGOs, private landowners, etc. to promote conservation and restoration of salt dome hardwood forests.
2. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamplets and the LDWF website.
3. Support NRCS and DNR efforts to stabilize shorelines and restore this habitat type.
4. Support surveys to estimate the presence of invasives plant and animal species in remaining habitat.
5. Develop strategies to address damage from feral hogs within this habitat type.

References:

LNHP. 1986-2004. The natural communities of Louisiana. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

Reese, W.D., and J. W. Thieret. 1966. Botanical study of the Five Islands of Louisiana . Castanea 31: 251-277.

26. Salt Marsh

Rarity Rank: S1/G1
Synonyms: Smooth Cordgrass Marsh, Saltgrass Marsh, Saline Marsh
Ecological Systems:
CES203.468 Gulf Coast Chenier Plain Salt and Brackish Tidal Marsh
CES203.471 Mississippi Delta Salt and Brackish Tidal Marsh

General Description:

Typically, salt marsh is the marsh area closest to the beach rim of the Gulf of Mexico, and, in general, varies from 1-15 miles in width. These marshes are regularly tidally flooded, flat, polyhaline areas dominated by salt-tolerant grasses and very few other species. Small pools or ponds may be scattered. Salt marsh has the least plant diversity and the lowest soil organic matter content of any marsh type. The community is often totally dominated by *Spartina alterniflora* (smooth cordgrass). Significant associate species includes *S. patens* (wiregrass), *Distichlis spicata* (salt grass), *Juncus roemarianus* (black rush), and *Batis maritima* (salt wort). Two other major groups of autotrophs found in Salt Marsh are microscopic algae on the surface of the vascular plants, and benthic algae (usually diatoms) living on or in the marsh sediment. Soil and water conditions regulate plant growth and salinity appears to be the primary factor determining species composition. The mean salinity of salt marsh is about 16 ppt. The area of salt marsh is increasing apparently due to salt-water intrusion resulting in shifts in marsh salinity levels. Salt marsh acts as nursery areas for myriads of larval forms of shrimp, crabs, redfish, seatrout, menhadden, etc., and greatly enhances the production of marine organisms directly related to the enormous primary productivity of the marsh vegetation. Factors which promote the growth of salt marsh plants include: 1) a long growing season, 2) abundant rainfall, 3) presence of soil nutrients, 4) low tide differential and tidally transported nutrients. Natural factors negatively impacting salt marsh include prolonged periods of inundation caused by winds, tides, or rain, especially those periods associated with hurricanes, subsidence, and erosion. Salt marsh also functions as a nitrogen and phosphorus sink (at least seasonally), thereby improving the quality of water that passes through it. In addition, it can aleviate the effects of storms and flooding by acting as a buffer and providing storage for large amounts of water.

Current Extent and Status:

Salt marsh is estimated to have occupied 500,000 to 1,000,000 acres in presettlement times, with an estimated 50 to 75 % remaining (Smith 1993). Salt marsh is most extensive on the deltaic plain of southeast Louisiana. The area of Salt Marsh is currently

increasing apparently due to salt-water intrusion resulting in shifts in marsh salinity levels (LNHP 1986-2004). However, coastal erosion is a threat as it results in conversion of marsh to open shallow water.

There are a number of conservation areas in the Louisiana marsh managed by state and federal agencies. The management of these sites is aimed at preserving and improving wintering waterfowl habitat. This involves the use of water control structures to regulate water and salinity input, water/sediment diversions to abate marsh deterioration, and prescribed burning to improve habitat and food quality for wildlife. These management activities are necessary since the leveeing and chanelization of waterways altered their hydrology and many canals have been cut in the marsh for navigation and oil and gas exploration which serve as avenues for salt water intrusion. The Chenier plain will continue to deteriorate due to lack of sediment deposition by long shore currents which occurred historically when the Mississippi River shifted further west.

Few conservation areas support extensive salt marsh. Wisner WMA consists of 21,000 acres and supports almost entirely salt marsh. Biloxi WMA (nearly 40,000 acres) features mostly brackish marsh but supports a sizeable area of salt marsh along Lake Borgne. Marsh Island Wildlife Refuge (70,000 acres), Rockefeller Wildlife Refuge (76,000 acres), and State Wildlife Refuge (13,000 acres) support salt marsh along the Gulf of Mexico. The acreages of salt marsh for these refuges is unknown but appears to account for a small portion of these sites.

SALT MARSH **SPECIES OF CONSERVATION CONCERN (26)**		
BIRDS	Gull-billed Tern	**BUTTERFLIES**
Reddish Egret	Caspian Tern	Neamathla Skipper
Yellow-crowned Night-Heron	Royal Tern	Dion Skipper
Northern Harrier	Sandwich Tern	Obscure Skipper
Black Rail	Common Tern	Great Southern White
Clapper Rail	Forster's Tern	Western Pygmy-Blue
Whooping Crane	Black Skimmer	
American Oystercatcher	Short-eared Owl	**REPTILES**
Marbled Godwit	Seaside Sparrow	Mississippi Diamondback Terrapin
Dunlin	Nelson's Sharp-tailed Sparrow	
Short-billed Dowitcher		

Priority Species Research and Survey Needs:

Seaside Sparrow and Nelson's Sharp-tailed Sparrow: Surveys are needed to determine their current abundance and distribution in relation to marsh changes. Large populations should be monitored on a scheduled basis to detect long-term population trends and to guide management decisions.

Black Rail: Determine current distribution and winter abundance in coastal areas.

Reddish Egret: Surveys are needed to assess limiting factors on reproductive success and the effects of human coastal recreational activities on bird populations.

Waterbirds: Continue to conduct rookery surveys to update database information.

Butterflies: Conduct surveys to determine current distribution and abundance of all butterfly species, especially species of conservation concern, for inclusion in the LNHP database.

Mississippi Diamondback Terrapin: Current population status in Louisiana is unknown. Drastic declines are apparent in other states, but the cause of these dclines is unknown. Review Marine Fisheries seine records and conduct replicate surveys to evaluate population trends.

Species Conservation Strategies:

1. Terns:
   - Disturbance and loss of nesting habitat are major threats to terns. Develop partnerships to strengthen the protection and restoration of barrier islands.
   - Develop a comprehensive survey methology to determine long-term trends in population abundances.
2. Shorebirds, Wading Birds:
   - Provide public education regarding the importance of waterbird nesting colonies and shorebird feeding areas. Reduce the negative effects on these areas from recreation and other uses.
   - Work with landowners to implement management and conservation recommendations for waterbirds (especially rails) of SWG project T18 upon completion.
   - Coordinate with GCJV to implement recommendations of shorebird and wading bird conservation plans.
   - Disturbance and loss of nesting habitat are major threats to these species. Continue to protect and restore coastal marshes. Develop new and/or improve existing partnerships to achieve this goal.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat			
Source of Threat	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Shoreline Erosion
Commercial/industrial development	XXX	XXX	XXX	
Construction of navigable waterways	XXX	XXX		XXX
Development/maintenance of pipelines, roads or utilities	XXX	XXX		
Invasive/alien species	XXX			
Levee or dike construction	XXX	XXX		XXX
Residential development	XXX	XXX		

Habitat Conservation Strategies:

1. Provide public education and support existing efforts/programs regarding invasive species; coordinate these efforts with LSU Ag Extension agents, NRCS, Sea Grant (rapid assessment projects – Calcasieu), etc.
2. Review oversight capabilities of DOTD, LDEQ, LDNR and other agencies to enforce constuction specifications and recommendations of permits issued by these agencies.
3. Support NRCS and LDNR efforts for shoreline stabilization and habitat restoration.
4. Work with LCA, CWPPRA to support coastal restoration projects, specifically targeting important nesting areas and species of conservation concern.
5. Work with COE and state agencies to insure water control structures provide the maximum benefit to salt marsh.
6. Work with NRCS Plant Materials Center and BTNEP to develop viable cultivaras for marsh restoration efforts.

References:

CHABRECK, R. H., AND G. LINSCOMBE. 1988. Louisiana coastal marsh vegetative type maps. Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

LNHP. 1986-2004. The natural communities of Louisiana. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

SMITH, L. M. 1993. Estimated presettlement and current acres of natural plant communities in Louisiana. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

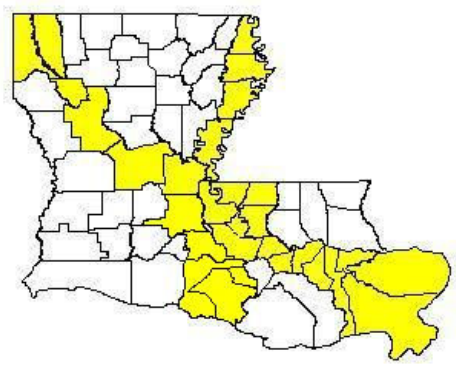
27. Sandbars

Rarity Rank: S4S5/G4
Synonyms: River Sandbar
Ecological Systems: None

General Description:

A sand/gravel deposit in or adjacent to permanently flowing freshwater contained within a natural channel. They are formed from course to fine-drained alluvial deposits. The community structure is dependent on the mix and stability of substrate, severity and depth of flooding, and permanent nature of the particular site. The hydrologic regime ranges from intermittently exposed to intermittently flooded. If present, vegetation is dominated by sparse to dense growth of shrubby or herbaceous plants. *Cephalanthus occidentalis* (buttonbush), and *Sambucus canadensis* (elderberry) are common shrubs, and *Salix nigra* (willow) and *Populus deltoides* (cottonwood) are common tree species (Jones 2004). Herbs include *Scirpus* spp. (bulrush), Carex spp. (sedges), and *Juncus* spp. (rushes) (LNHP 1986-2004). The community is successional in nature but generally remains unforested because of repeated flood disturbance. Also due to the early successional nature of sandbars they can be invaded by exotic plant species (NatureServe 2005). These areas are critical nesting areas for the federally-endangered interior least tern (*Sterna antillarum athalassos*).

Current Extent and Status:



Sandbar habitat within the Mississippi River has shown a general decline over the past 50 years. The U.S. Army Corps of Engineers reported a 33 % decrease in sandbar habitat in the lower Mississippi River between Memphis, Tennessee and Baton Rouge, Louisiana from 1948 to 1994 (U.S. Fish and Wildlife Service 2005). Major threats exist from channelization, water diversions, frequent and prolonged

fluctuations in river water levels, changes in vegetation, and disturbance from recreational use. More research on these areas, particularly in relation to nesting tern colonies, is warranted.

SANDBARS SPECIES OF CONSERVATION CONCERN (14)		
BIRDS	Common Tern	Ringed Map Turtle
Piping Plover	Forster's Tern	Ouachita Map Turtle
American Oystercatcher	Interior Least Tern	Sabine Map Turtle
Dunlin		Pascagoula Map Turtle
Gull-billed Tern	**REPTILES**	Stripe-necked Musk Turtle
Caspian Tern	Alligator Snapping Turtle	

Priority Species Research and Survey Needs:

Terns: Continue to support nesting surveys and initiate research that focuses on factors (such as predation, human disturbance, etc.) effecting overall population densities.

Species Conservation Strategies:

1. Interior Least Tern:
   - Implement conservation recommendations of USFWS recovery plan (USFWS 1990b).
   - Work with COE to regulate water levels during breeding season.
   - Determine feasibility of using abandoned barges as artificial nesting habitat (Hervey 2001).
   - Provide funding to support long term efforts to locate and monitor nest colonies.
2. Map Turtles: Sandbars and beaches provide primary nesting sites, and submerged portions are used for foraging. Eliminate off-road vehicles from sandbars and beaches during nesting periods.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat: Habitat Disturbance	Threat: Modification of Water Levels; Changes in Natural Flow Patterns
Channelization of rivers or streams		XXX
Levee or dike construction		XXX
Operation of drainage or diversion systems		XXX
Recreational use/vehicles	XXX	
Shoreline stabilization		XXX

Habitat Conservation Strategies:

1. Determine ownership/management authority for sandbars in the Red and Mississippi rivers.
2. Support vegetation control for sandbars and research on this habitat.
3. Work with COE to develop Memorandum Of Understanding (MOU) regarding sandbar management.
4. Work with the appropriate agencies to develop limits on recreational vehicle use of this habitat.

References:

HERVEY, H. 2001. Nesting success of least turns on the Red River of Louisiana. The Journal of Louisiana Ornithology 5(1):1-21.

JONES, K. H. 2004. Population survey of the interior least tern on the Mississippi River from Cape Girardeau, Missouri to Baton Rouge, Louisiana. Report to U.S. Army Corps of Engineers, Memphis District.

LNHP. 1986-2004. The natural communities of Louisiana. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

NATURESERVE. 2005. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.2. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: June 27, 2005).

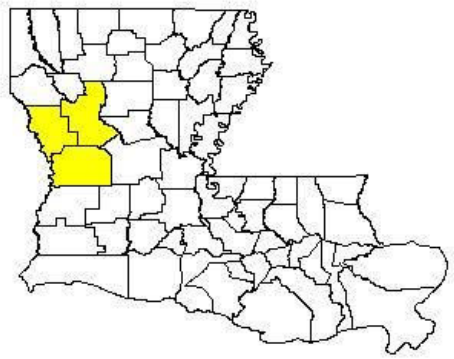
28. Sandstone Glade/Barren

Rarity Rank: S1S2/G1G2
Synonyms: Catahoula Barren, Sandstone Outcrop
Ecological Systems: CES203.364 West Gulf Coastal Plain Catahoula Barrens

General Description:

This natural community develops on outcropping sandstone in pine forests, chiefly in a belt running from northeast to southwest across central Louisiana, and is primarily associated with the Catahoula formation. The community appears as a complex of sandstone boulders, intermixed with shrubs and trees occurring as individuals or in patches. Associated soils are characteristically acidic and are highly erodable, often eroding to form an irregular, sandstone-studded landscape of gullies, bluffs, and miniature gorges and buttes. Much of the soil and rock is unvegetated. Tree species present may include *Pinus palustris* (longleaf pine), *P. echinata* (shortleaf pine), *P. taeda* (loblolly pine), *Quercus stellata* (post oak), *Q. incana* (bluejack oak), *Q. marilandica* (blackjack oak), and *Liquidambar styraciflua* (sweetgum). Shrubs may include *Ilex vomitoria* (yaupon), *Vaccinium arboreum* (winter huckleberry), *V. elliottii* (Elliott's blueberry), *Bumelia lanuginosa* (chittum-wood), and *Crataegus* spp. (hawthorns). Common herbaceous species are *Bigelowia virgata* (rayless goldenrod, often the dominant herb), *Andropogon* spp. (broomsedges), *Eragrostis* spp. (love grasses), *Liatris* spp. (blazing-stars), and *Aster* spp. (asters). *Talinum parviflorum* (small-flowered flame-flower) may rarely be present. Saxicolous mosses and lichens abound.

Current Extent and Status:



Sandstone glades are thought to have occupied less than 2,000 acres in presettlement times with an estimated 50 to 75% remaining today (Smith 1993). Most known occurrences are on the Kisatchie District of KNF in southern Natchitoches Parish. There are a handful of known glades on private land in varying condition. There are probably more examples of this habitat both on KNF and on private lands.

SANDSTONE GLADE BARREN SPECIES OF CONSERVATION CONCERN (6)		
AMPHIBIANS	**BIRDS**	**BUTTERFLIES**
Southern Red-backed Salamander	Chuck-Will's-Widow	Cobweb Skipper
	Loggerhead Shrike	
	Field Sparrow	**REPTILES**
		Western Slender Glass Lizard

Priority Species Research and Survey Needs:

Chuck-Will's-Widow: Research is needed to better understand this species' population dynamics. Studies should focus on distribution patterns, habitat availability and use, nesting success, and territory size requirements. Implementation of night-time surveys along with sighting reports by foresters, birders, etc. are needed to augment sparse BBS records.

Loggerhead Shrike: BBS data for the period 1966-2000 indicate a 71% population decline rangewide. Monitoring of reproductive success and the effects of pesticides on food availability are needed along with a statewide evaluation of changes in available habitat.

Cobweb Skipper: Conduct surveys to determine current distribution and abundance for inclusion in the LNHP database.

Western Slender Glass Lizard: Occurrence in Sandstone Glades likely but imperfectly known. Glass lizards are declining over much of their range, regardless of habitat alteration. Determine the extent of any correlations between glass lizard occurrence and Sandstone Glades.

Species Conservation Strategies:

1. Chuck-Will's-Widow: Work with federal agencies and bird conservation organizations to produce technical pamphlets highlighting the habitat and management requirements of this species and make available to landowners.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat: Altered Composition/ Structure	Threat: Habitat Disturbance
Fire suppression	XXX	
Incompatible forestry practices	XXX	XXX
Recreational use/vehicles	XXX	XXX

Habitat Conservation Strategies:

1. Conduct surveys to determine the current extent and condition of this habitat type.
2. Develop educational materials about the importance and rarity of this habitat for the general public.
3. Encourage the use of precribed fire as a management tool.
4. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamplets and the LDWF website.
5. Support research on the community classification of sandstone glades.

References:

LNHP. 1986-2004. The natural communities of Louisiana. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

MACROBERTS, M. H., AND B. R. MACROBERTS. 1991. The distribution of *Sarracenia* in Louisiana, with data on its abundance in the western part of the state. Phytologia 70(2):119-125.

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MACROBERTS, B. R., AND M. H. MACROBERTS. 1993. Floristics of two Louisiana sandstone glades. Phytologia 74(6):431-437.

MARTIN, C. 2002. Riparian Habitat Management for Mammals on Corps of Engineers Projects. Ecosystem Management and Restoration Research Program, ERDC TN-EMRRP-SI-29.

MARTIN, D. L., AND L. M. SMITH. 1991. A survey and description of the natural plant communities of The Kisatchie National Forest, Winn and Kisatchie Districts. Louisiana Department of Wildlife and Fisheries, Baton Rouge.

SMITH, L. M.1993. Estimated presettlement and current acres of natural plant communities in Louisiana currently recognized by the Louisiana Natural Heritage Program. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

29. Shortleaf Pine/Oak-Hickory Forest

Rarity Rank: S2S3/G2G3
Synonyms: Shortleaf Pine-Oak, Oak-Hickory Forest
Ecological Systems:
CES203.378 West Gulf Coastal Plain Pine-Hardwood Forest
CES203.506 East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest

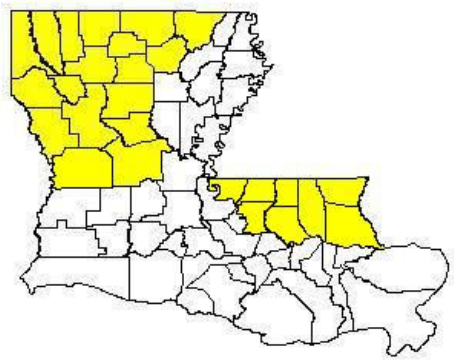
General Description:

The Shortleaf Pine/Oak-Hickory Forest community (SLPOH) occurs on dry hills, principally in central and northern Louisiana, although it may occur sporadically in the Florida Parishes. In the Upper West Gulf Coastal Plain, this was the most prevalent community on the landscape (i.e., it was the matrix community).

Principle overstory species include *Pinus echinata* (shortleaf pine), *Pinus taeda* (loblolly pine), *Quercus falcata* (southern red oak), *Q. stellata* (post oak), *Q. marilandica* (blackjack oak), *Q. velutina* (black oak), *Q. alba* (white oak), *Q. pagoda* (cherrybark oak), *Q. shumardii* (shumard oak), *Carya tomentosa* (mockernut hickory), *C. texana* (black hickory), *C. cordiformis* (bitternut hickory), *Ulmus alata* (winged elm), *Fraxinus americana* (white ash), *Nyssa sylvatica* (black gum), *Liquidambar styraciflua* (sweetgum), and *Acer rubrum* (red maple). Midstory and understory shrubs may include *Vaccinium arboreum* (winter huckleberry), *Vaccinium virgatum* (bunch blueberry), *Bumelia lanuginosa* (chittum-wood), *Callicarpa americana* (french mulberry), *Viburnum rufidulum* (rusty blackhaw), *Ilex decidua* (deciduous holly), *Crataegus* spp. (hawthorns), and *Prunus mexicana* (Mexican plum). Herbaceous flora is usually sparse but may consist of *Eurybia* spp. and *Symphyotrichum* spp. (asters), *Solidago* spp. (goldenrods), *Silphium* spp. (rosin-weeds), *Antennaria plantaginifolia* (plantain-leaf pussy-toes), *Desmodium* spp. (beggar-ticks), *Trillium* spp. (wake-robbins), *Chasmanthium* spp. (spangle-grasses), *Viola* spp. (violets), *Mitchella repens* (partridge-berry), *Helianthus* spp. (sunflowers), *Liatris* spp. (blazing-stars), and *Panicum* spp. (panic grasses).

Fire is an important process in this communtiy. Historical fire frequency is thought to have been 5 to 15 years (Martin and Smith 1993). Oak-hickory forest is the theoretical climax forest stage beyond shortleaf pine/oak-hickory forest in central and north Louisiana. However, no occurrences of oak-hickory forest lacking shortleaf pine have been observed, probably because disturbance has been frequent enough to allow perpetuation of shortleaf pine in the community. It is thought species composition would be essentially similar to that of shortleaf pine/oak-hickory forests. At times, this community may take on the aspect of what has been termed loblolly-shortleaf pine forest.

Current Extent and Status:



There was an estimated 4,000,000 to 6,000,000 acres of SLPOH in Louisiana and of this original extent 5 to 10 percent is thought to remain today (Smith 1993). Most of this acreage by far was in northwestern Louisiana in the UWGCP.

Currently there are 4 known high-quality occurrences of SLPOH in the UWGCP in the LNHP database. These sites total aprroximately 160 acres. There are 2 known additional sites, one in Caddo Parish on Eddie Jones Parish Park that have not been surveyed thoroughly and another in Claiborne Parish on Summerfield Springs Preserve owned by TNC. Eddie Jones Park occurrence is at least 100 acres (L. Raymond, personal communication) and the TNC preserve is a little less than 100 acres. Much of this communtiy has been lost or degraded due to conversion of forest types and fire suppression (NatureServe 2005).

There are about 15 known occurrences in the WGCP and a handful in the Florida Parishes on the EGCP. Several of these are on conservation areas such as KNF.

SHORTLEAF PINE – OAK – HICKORY FOREST SPECIES OF CONSERVATION CONCERN (41)		
AMPHIBIANS	Swainson's Warbler	**MAMMALS**
Louisiana Slimy Salamander	Kentucky Warbler	Southeastern Shrew
Southern Crawfish Frog	Hooded Warbler	Southeastern Myotis
	Painted Bunting	Silver-haired Bat
BIRDS	Bachman's Sparrow	Big Brown Bat
Bald Eagle	Field Sparrow	Louisiana Black Bear
American Woodcock	Rusty Blackbird	Ringtail
Yellow-billed Cuckoo	Orchard Oriole	Long-tailed Weasel
Chuck-Will's-Widow		Eastern Spotted Skunk
Red-cockaded Woodpecker	**BUTTERFLIES**	
Brown-headed Nuthatch	Wild Indigo Duskywing	**REPTILES**
Wood Thrush	Dusted Skipper	Western Slender Glass Lizard
Bell's Vireo	Pepper and Salt Skipper	Southern Prairie Skink
Yellow-throated Vireo	Yucca Giant Skipper	Southeastern Scarlet Snake
Northern Parula	Falcate Orangetip	Timber Rattlesnake
Prairie Warbler	Harvester	
Worm-eating Warbler	Little Metalmark	

Priority Species Research and Survey Needs:

Bachman's Sparrow: Intensive surveys are needed to produce estimates of current population size statewide. Develop projects which determine the relationship between population size and vegetation succession on quality sites. Determine whether management activities can create a mosaic of adjacent sites that together provide continuously occupied habitat. Determine dispersal behavior to maximize the benefits/effects of future habitat management.

Chuck-Will's-Widow: Research is needed to better understand the population dynamics of this species. Studies should focus on distribution patterns, habitat availability and use, nesting success, and territory size requirements. Implementation of night-time surveys along with sighting reports by foresters, birders, etc. are needed to augment spares BBS records.

Brown-headed Nuthatch: Investigate the impacts of silviculture/land management practices and their effects on species declines.

Rusty Blackbird: Initiate surveys to determine wintering population abundances and habitat use to augment Christmas Bird Counts.

Songbirds: Continued research on silviculture/land management practices and their effects on all songbird species.

Butterflies: Conduct surveys to determine current distribution and abundance of all butterfly species, especially species of conservation concern, for inclusion in the LNHP database.

Ringtail: Louisiana represents the eastern edge of its range, intensive surveys are needed to determine its current status in Louisiana.

Eastern Spotted Skunk: Considered critically imperiled in Louisiana, intensive surveys are needed to update occurrence records and abundance for inclusion in LNHP database.

Southeastern Shrew: Considered imperiled in Louisiana. Together with Arkansas and Missouri, Louisiana represents the western edge of its range. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Bats: Develop projects that target species of conservation concern. Conduct research which focuses on their distribution, abundance, and ecological needs in this habitat type (Lacki and Schwierjohann 2001).

Establish monitoring systems and protocols for all bat and mammal species of conservation concern associated with shortleaf pine-oak-hickory forest.

Determine the microhabitat preferences and requirements of species occuring in shortleaf pine-oak-hickory forest to understand how these species are utilizing this habitat in order to develop management guidelines for these species.

Species Conservation Strategies:

1. Louisiana Slimy Salamander: Requires intact, relatively old-growth forest. Encourage timber companies to designate no-cut zones, especially on slopes and riparian borders.

2. Bachman's Sparrow:
   - Implement recommendations of SWG project T22 upon completion.
   - Monitor reproductive success of Bachman's sparrows to determine limiting factors.
   - Work with landowners to encourage the use of BMPs for prescribed fire management and timber harvesting techniques to improve habitat quality.
3. Chuck-Will's-Widow: Work with federal agencies and bird conservation organizations to produce technical pamphlets highlighting the habitat and management requirements of this species and make them available to landowners.
4. Brown-headed Nuthatch: Encourage landowners to use group-selection and single-tree selection harvesting methods and maintain or increase the number of standing snags.
5. Louisiana Black Bear: Partner with the BBCC, USFWS and continue to support the implementation of recovery efforts for this species.
6. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.
7. Encourage snag retention during logging operations to increase the numbers available for cavity-nesting species. Efforts need to be made to maintain sufficient levels of woody debris in stands for reptiles, amphibians and small mammals.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat			
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Conversion to agriculture or other forest types		XXX		XXX
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX
Fire suppression	XXX			
Incompatible forestry practices	XXX		XXX	
Invasive/alien species	XXX		XXX	
Mining practices		XXX		XXX
Recreational use/vehicles			XXX	
Residential development		XXX	XXX	XXX

Habitat Conservation Strategies:

1. Conduct surveys to determine the current extent and condition of this habitat type.
2. Develop best management practices for restoration of this habitat type including appropriate fire regimes and herbicide uses.
3. Work with USFS, Department of Defense (DOD), and Office of State Lands to encourage the conservation and restoration of this habitat where it exists on public lands.
4. Encourage LDAF and other growers to produce shortleaf pine seedlings for distribution to landowners interested in restoring this habitat type.
5. Develop partnerships with federal and state agencies, NGO's and others to identify potential parcels of this habitat type for acquisition and conservation.
6. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
7. Provide education/outreach to illustrate the value of this habitat to wildlife and to promote conservation and preservation of this habitat type.

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30. Slash Pine-Pondcypress/Hardwood Forest

Rarity Rank: S2S3/G3?
Synonyms: Slash Pine-Hardwood
Ecological Systems: CES203.375 East Gulf Coastal Plain Near-Coast Pine Flatwoods

General Description:

This natural wetland forest type is restricted to the wet acidic flatwoods on the far eastern Pleistocene prairie terraces of Louisiana's EGCP. It is found in a mosaic with longleaf pine flatwoods and savannahs, and bayhead swamps, existing in a hydrologic/topographic transitional zone between the higher, "drier" longleaf pine flatwood savannahs to the lower, wetter bayhead swamps. It may also be present on broad flats that were historically partially protected from frequent surface fires by surrounding bayheads or seeps. Soils of the slash pine/pondcypress forests are hydric, strongly acidic and nutrient poor silt loams and fine sandy loams. Two principal soils are Myatt fine sandy loam and Guyton silt loam. Surface soils are typically saturated for much of the year and shallow water may be present in the late fall/winter/early spring and after rains during the growing season.

The community seems to vary considerably in structure and somewhat in composition from one place to another, apparently as a consequence of minor variations in topography, soil conditions, and hydrologic and fire regimes (LNHP 1986-2004, Teague et al. 1995). The typically closed canopy is dominated by *Pinus elliottii* (slash pine) and *Taxodium ascendens* (pondcypress), with *Nyssa biflora* (swamp black gum) and *Magnolia virginiana* (sweetbay) as primary associates. The understory is often dense, with *Cyrilla racemiflora* (swamp cyrilla), *Ilex coriacea* (sweet gallberry), *Lyonia lucida* (fetterbush), *I. glabra* (littleleaf gallberry), *Itea virginica* (Virginia willow), *Morella heterophylla* (bigleaf waxmyrtle), and *M. cerifera* (waxmyrtle) characteristic species. *Sphagnum* spp. (sphagnum moss), *Pteridophytes* (ferns), and *Smilax* spp. (greenbriers) are common. There is minimal herbaceous undergrowth, but *Arundinaria gigantea* (switch cane) can form dense thickets, and usually there are many acid loving wetland shrubs. Scattered, depauperate specimens of herbs, more typical of sunny wet pine savannahs (e.g., *Sarracenia alata*, yellow pitcher-plant), may be observed. Pondcypress may dominate minor depressions (LNHP 1986-2004, Penfound and Watkins 1937).

Slash pine-pondcypress/hardwood forest evolved with recurrent lightning-season ground fires and regular light surface fire appears critical in maintaining this community. Both slash pine and pondcypress are fire-adapted species and can survive fires once they attain a certain size; however, neither is as fire resistant as longleaf pine. The natural fire

return interval of this community is difficult to estimate but is tentatively believed to have varied on the average between 5 and 20 years, a frequency that would periodically allow for the regeneration of slash pine and pondcypress, and associated hardwoods during the longer fire return intervals. Such a frequency would as well preclude complete dominance of the site by hardwoods (Smith 1996).

Current Extent and Status:

In the EGCP of Louisiana, the slash pine-pondcypress/hardwood community is primarily associated with pine flatwoods including eastern longleaf pine savannah and occassional bogs. Presettlement extent of this habitat is estimated at 50,000 to 100,000 acres, with only 10 to 25% currently remaining (Smith 1993, Smith 1999). The Nature Conservancy's Abita Creek and Talisheek Preserves in St. Tammany Parish contain the only protected examples of this community type. These preserves encompass approximately 3,768 total acres which also include longleaf pine savannahs and flatwoods, seepage bogs, bayhead swamps and riparian forests. There are some examples of the slash pine-pondcypress/hardwood community on commercial timberlands and sites owned by commercial developers, however the extent of these acres is unknown.

SLASH PINE – PONDCYPRESS – HARDWOOD FOREST SPECIES OF CONSERVATION CONCERN (22)		
AMPHIBIANS	**BIRDS**	Hooded Warbler
Southern Dusky Salamander	Yellow-crowned Night-Heron	Orchard Oriole
Gulf Coast Mud Salamander	Swallow-tailed Kite	
Oak Toad	American Woodcock	**MAMMALS**
Barking Treefrog	Yellow-billed Cuckoo	Southeastern Shrew
Ornate Chorus Frog	Wood Thrush	Southeastern Myotis
Eastern Spadefoot	Yellow-throated Vireo	Long-tailed Weasel
Dusky Gopher Frog	Northern Parula	
	Prothonotary Warbler	**REPTILES**
	Kentucky Warbler	Pine Woods Littersnake

Priority Species Research and Survey Needs:

Southern Dusky Salamander, Gulf Coast Mud Salamander: Both species are exhibiting drastic declines in relatively pristine areas throughout their range. However, the status of neither species is being addressed by the Federal government. Initiate status surveys at reference sites to determine the extent of declines in protected sites (e.g., Talisheek Bay).

Swallow-tailed Kite: Continued to inventory and monitor Swallow-tailed Kites on public and private lands to fill data gaps in their distribution and abundance for inclusion in the LNHP database and Audubon nationwide database.

Yellow-billed Cuckoo: Continue to monitor populations throughout the state to establish abundance patterns.

Songbirds:

- Continue to support research on silviculture/land management practices and their effects on all songbird species.
- Develop longterm monitoring projects that focus on abundances and reproductive success (with emphasis on species of conservation concern) in this habitat type through the establishment of MAPS stations and BBS routes.

Southeastern Shrew: Considered imperiled in Louisiana. Together with Arkansas and Missouri, Louisiana represents the western edge of its range. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Species Conservation Strategies:

1. Swallow-tailed Kite: Implement conservation and management recommendations of SWG project T9 (Coulson 2004).
2. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.
3. Establish monitoring systems and protocols which focus on small mammal population abundances and trends.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat				
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns
Channelization of rivers or streams					XXX
Commercial/industrial development		XXX			
Construction of ditches, drainage or diversion systems	XXX		XXX		XXX
Conversion to agriculture or other forest types		XXX		XXX	
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX	
Fire suppression	XXX				
Incompatible forestry practices	XXX		XXX		XXX
Invasive/alien species	XXX				
Residential development		XXX	XXX	XXX	

Habitat Conservation Strategies:

1. Conduct surveys to determine the extent and condition of this habitat type with a focus on identifying the surrounding landscape context (i.e., residential developments, etc.) that might be affected by prescribed burning.
2. Work with appropriate planning commissions to provide them with LNHP data that illustrates locations of this habitat type.
3. Develop BMPs for ephemeral ponds.
4. Develop educational information regarding the importance of ephemeral ponds for species of concern and make this information available to landowners/land managers through technical pamplets and the LDWF website.
5. Educate landowners, adjacent residents, developers, and the general public about the crucial role of prescribed burning in the management of slash pine/hardwood systems (multi-agency, multi-group effort).
6. Continue to encourage landowners to implement BMPs and adopt SFI standards in the management of this habitat type.
7. Provide additional cost share funds for landowners to drastically reduce or eliminate costs associated with conducting prescribed burns their property.

8. Promote utilization of federal cost share programs (NRCS) to address invasive species problems.
9. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.

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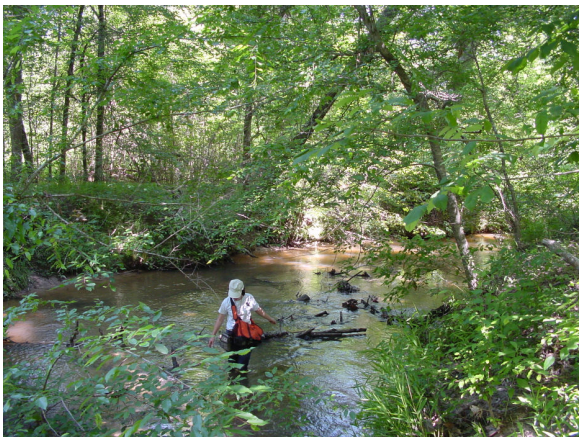
31. Small Stream Forest

Rarity Rank: S3/G3
Synonyms: Riparian Forest, Small Stream Floodplain Forest, Creek Bottom Forest, Sandy Branch Bottom, Upland Stream Forest, Hammock
Ecological Systems:
CES203.559 East Gulf Coastal Plain Small Stream and River Forest
CES203.487 West Gulf Coastal Plain Small Stream and River Forest

General Description:



Small stream forests are relatively narrow wetland forests occurring along small rivers and large creeks in central, western, southeastern, and northern Louisiana. They are seasonally flooded for brief periods. The percentage of sand, silt, calcareous clay, acidic clay, and organic material in the soil is highly variable (depending on local geology) and has a significant effect on species composition. Soils are typically classified as silt-loams. At times, the community is quite similar in species composition to hardwood slope forests (beech-magnolia forests). These forested wetlands are critical components of the landscape filtering surface and subsurface flows, improving water quality, and storing sediment and nutrients (Rummer 2004). Common trees include *Magnolia grandiflora* (southern magnolia), *Fagus grandifolia* (beech), *Nyssa sylvatica* (blackgum), *Quercus michauxii* (swamp white oak), *Q. alba* (white oak), *Q. nigra* (water oak), *Q. laurifolia* (laurel oak), *Q. pagoda* (cherrybark oak), *Liquidambar styraciflua* (sweetgum), *Platanus occidentalis* (sycamore), *Acer rubrum* (red maple), *Betula nigra* (river birch), *Carya ovata* (shagbark hickory), *Carya cordiformis* (bitternut hickory), *Fraxinus americana* (white ash), *F. caroliniana* (water ash), *Prunus caroliniana* (cherry laurel), *Ulmus alata* (winged elm), and *Liriodendron tulipifera* (yellow poplar, southeastern and central Louisiana). *Pinus glabra* (spruce pine) is a common associate in the Florida Parishes, and *Taxodium distichum* (baldcypress) and *Pinus taeda* (loblolly pine) are occassional associates statewide. *Magnolia virginiana* (sweet bay) and *M. macrophylla* (bigleaf magnolia) may be present. Primary midstory and understory associates include *Halesia diptera* (silverbell), *Carpinus caroliniana* (ironwood), *Viburnum dentatum* (arrow-wood), *Itea virginica* (Virginia willow), *Symplocos tinctoria* (sweetleaf), *Alnus serrulata* (hazel alder), *Rhododendron canescens* (wild azalea) and *Styrax grandifolia* (bigleaf snowbell). *Illicium floridanum* (starbush) and *Sebastiana fruticosa* (sebastian bush) are common in the Florida Parishes, the former at times being the dominant understory shrub. *Cyrilla racemiflora* (swamp cyrilla), *Lyonia lucida* (fetterbush), *Leucothoe axillaris* (leucothoe), *L. racemosa* (leucothoe), and *Ilex verticillata* (winterberry) are common understory affiliates in the

eastern Florida Parishes. *Isoetes louisianensis* (Louisiana quillwort), an aquatic fern that is federally-listed as endangered, occurs in and along streams clothed by small stream forests in the eastern Florida Parishes. Communities possessing physical characteristics and species complement of both riparian forest and bayhead swamp occur in central and northern Louisiana.

Current Extent and Status:

Riparian forests are extremely susceptible to damage, and only an estimated 25 to 50% of Louisiana's original small stream forests remain intact (Smith 1993). Initial habitat loss, degradation and fragmentation of these forested wetlands was due primarily to agricultural conversion and timber harvesting. With the implementation of BMPs for forestry and agricultural uses, current source for stream habitat destruction has shifted primarily to urbanization, although silvicultural and agricultural activities are still contributing some threat (Rummer 2004). The Louisiana Natural and Scenic River System (LNSRS) program currently monitors and protects 70 streams or stream segments in the state with over 3,300 miles of streams in the system. The LNSRS has been effective in protecting some of the state's riparian forests, however this is only a very small portion of the total stream miles in the state (about 19%). Streams or portions of streams on both federal and state public lands such as KNF and various state parks and WMAs are also afforded some protection. The Natural Areas Registry Program has 12 properties containing small stream forests with a total of 792 acres.

SMALL STREAM FOREST
SPECIES OF CONSERVATION CONCERN (36)

AMPHIBIANS
- Southern Dusky Salamander
- Four-toed Salamander
- Webster's Salamander
- Louisiana Slimy Salamander
- Southern Red-backed Salamander

BIRDS
- American Woodcock
- Yellow-billed Cuckoo
- Chuck-Will's-Widow
- Wood Thrush
- Bell's Vireo
- Yellow-throated Vireo
- Northern Parula
- Prothonotary Warbler
- Worm-eating Warbler
- Swainson's Warbler
- Louisiana Waterthrush
- Kentucky Warbler
- Hooded Warbler
- Rusty Blackbird
- Orchard Oriole

BUTTERFLIES
- Pepper and Salt Skipper
- Falcate Orangetip
- Harvester
- 'Seminole' Texan Crescent
- Creole Pearly Eye
- Appalachian Brown

MAMMALS
- Southeastern Shrew
- Southeastern Myotis
- Northern Myotis
- Silver-haired Bat
- Big Brown Bat
- Ringtail
- Long-tailed Weasel
- Eastern Spotted Skunk

REPTILES
- Common Rainbow Snake
- Timber Rattlesnake

Priority Species Research and Survey Needs:

Bell's Vireo: Initiate surveys to determine their population abundance and distribution in the northern portion of state and develop species management recommendations.

Songbirds: Continue research on the effects of silviculture/land management practices on all songbird species.

Butterflies: Conduct surveys to determine current distribution and abundance of all butterfly species, especially species of conservation concern, for inclusion in the LNHP database.

Bats:

- Northern Myotis: This species was first documented in Louisiana in 2003 (Crnkovic 2003). Conduct intensive surveys to determine its current status in Louisiana and to evaluate the importance of bridges as roost sites (Leberg 2004).
- Develop projects that target species of conservation concern and focus on their distribution, abundance, and ecological needs in this habitat type (Lacki and Schwierjohann 2001).
- Research the genetic identities of different Myotis species in the state (Leberg 2004).

Ringtail: Louisiana represents the eastern edge of its range. Intensive surveys are needed to determine its current status in Louisiana.

Eastern Spotted Skunk: Considered critically imperiled in Louisiana. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Long-tailed Weasel: Considered vulnerable in Louisiana. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Conduct habitat use and life history studies for mammal species of conservation concern that may potentially use this habitat.

Document the habitat relationships of species of conservation concern to understand how dependent they are upon small stream forest habitats, relative to other habitat types.

Species Conservation Strategies:

1. Louisiana Slimy Salamander: Requires intact, relatively old-growth forest. Encourage timber companies to designate no-cut zones in riparian bottoms.
2. Timber Rattlesnake: Naturally low-occurring population levels and persecution make persistence in isolated forest blocks untenable. Prohibit killing of timber rattlesnakes and retain the connectivity of required habitats.

3. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.
4. When appropriate, support recommendations by the EMRRP (Martin 2002).

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat							
Source of Threat	Altered Composition/ Structure	Altered Water Quality	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns	Sedimentation	Toxins/ Contaminants
Channelization of rivers or streams	XXX		XXX	XXX		XXX	XXX	
Commercial/industrial development			XXX	XXX	XXX		XXX	
Construction of ditches, drainage or diversion systems						XXX	XXX	
Conversion to agriculture or other forest types			XXX		XXX	XXX		
Dam construction	XXX		XXX		XXX	XXX	XXX	
Development/maintenance of pipelines, roads or utilities			XXX	XXX	XXX		XXX	XXX
Gravel mining		XXX	XXX				XXX	XXX
Incompatible forestry practices	XXX	XXX		XXX	XXX	XXX	XXX	XXX
Invasive/alien species	XXX			XXX			XXX	
Livestock production practices	XXX	XXX						
Mining practices			XXX				XXX	
Oil or gas drilling			XXX		XXX			
Parasites/pathogens	XXX							
Recreational use/vehicles				XXX				
Residential development			XXX	XXX	XXX		XXX	

Habitat Conservation Strategies:

1. Conduct a comprehensive state inventory on the status and condition of Louisiana's streams, including ownership patterns, landscape context and uses.
2. Work with TNC and other partners to develop guidelines and funding mechanisms for restoration of abandoned gravel mines.

3. Form a committee composed of gravel mining interests, LDEQ, LDNR, TNC, and other interested groups to develop BMPs for current and proposed gravel mines to prevent or reduce the impacts to streams and the surrounding forest habitat.
4. Develop educational information that focuses on the importance of streamside zones as wildlife corridors and distribute them to landowners/land managers through technical pamplets and the LDWF website.
5. Work with LFA to produce a publication for landowners which discusses BMPs for SMZs and methods for effective landowner/logger communication.
6. Where livestock production is an issue, encourage the use of Environmental Quality Incentives Program (EQIP) and other incentive programs to aid farmers in fencing off riparian zones and providing alternative water sources for livestock.

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32. Southern Mesophytic Forest

Rarity Rank: S2S3/G1G2
Synonyms: Relict Northern Hardwood Forest, Bluffland Forest, Beech-Magnolia Forest, Upland Hardwood Forest, Mixed Mesophytic Forest
Ecological Systems:
CES203.556 East Gulf Coastal Plain Southern Loess Bluff Forest
CES203.476 East Gulf Coastal Plain Southern Mesic Slope Forest

General Description:

This community is currently recognized in Louisiana only in the northwestern Florida Parishes, primarily in the region known as the Tunica Hills. It develops on deep, fertile, circum-neutral to slightly alkaline loessial deposits that have eroded over thousands of years to form a characteristic highly-dissected landscape of high, narrow ridges, steep slopes, and deep ravines (usually with intermittent to permanent streams). These topographic characteristics create a relatively cool, moist micro-climate on the slopes and in the ravines. Thus, these dissected hills have sustained localized populations of some characteristic Appalachian species, principally herbaceous, thought to have originally migrated south ahead of advancing glaciers in the past ice-age.

Overstory species include *Fagus grandifolia* (beech), *Quercus shumardii* (shumard oak), *Q. alba* (white oak), *Q. muhlenbergii* (chinkapin oak), *Q. michauxii* (cow oak), *Q. nigra* (water oak), *Liriodendron tulipifera* (yellow poplar), *Magnolia grandiflora* (southern magnolia), *M. acuminata* (cucumber magnolia), *M. pyramidata* (pyramid magnolia), *Ulmus americana* (American elm), *U. rubra* (slippery elm), *Tillia caroliniana* (Carolina basswood), *Morus rubra* (red mulberry), *Acer floridanum* (Florida sugar maple), *Carya glabra* (pignut hickory), *C. cordiformis* (bitternut hickory), *Fraxinus americana* (white ash), *Celtis laevigata* (hackberry), and *Platanus occidentalis* (sycamore). *Ilex opaca* (American holly) is rarely encountered as a tree, almost always as a shrub. No pine species are thought to be native to this habitat. Shrub species include *Lindera benzoin* (spice bush), *Hydrangea quercifolia* (oak-leaf hydrangea), *H. arborescens* (mountain hydrangea), *Asimina triloba* (paw-paw), *Euonomys americanum* (stawberry bush), *Halesia diptera* (silverbell), *Cercis canadensis* (red bud), *Sambucus canadensis* (elderberry), and *Ostrya virginiana* (hop-hornbeam). Thick stands of *Arundinaria gigantea* (giant cane) may be present, especially in ravine bottoms. Vines may include *Schisandra glabra* (smooth woodbine), *Vitis* spp. (grapes), *Bignonia capreolata* (cross-vine), *Trachelospermum difforme* (climbing dogbane), *Parthenocissus*

quinquefolia (Virginia creeper), and rarely *Celastrus scandens* (climbing bittersweet). The exotic vine *Lonicera japonica* (Japanese honeysuckle) has become a serious pest in many places.

The herbaceous flora is particularly rich in ferns, including *Adiantum pedatum* (northern maidenhair-fern), *Thelypteris* spp. (marsh ferns), *Athyrium thelypteroides* (silver glade-fern), *A. pycnocarpon* (glade-fern), *A. felix-femina* (southern lady fern), *Cystopteris protrusa* (lowland brittle-fern), *Polystichum acrostichoides* (christmas fern), *Botrychium virginianum* (rattlesnake fern), *B. biternatum* (southern grape-fern), *Asplenium platyneuron* (ebony spleenwort), and *Phegopteris hexagonoptera* (broad beech-fern). A number of exotic ferns are apparently thriving in the Tunica Hills. Additional herbs of prominence include *Sanicula* spp. (snakeroots), *Actaea pachypoda* (bane-berry), *Laportea canadensis* (nettle), *Podophyllum peltatum* (may-apple), *Trillium foetidissimum* (foetid wake-robin), *Cynoglossum virginianum* (hound's-tounge), *Aristilochia serpentaria* (dutchman's-pipe), *Cryptotaenia canadensis* (hone-wort), *Lithospermum tuberosum* (tuberous puccoon), *Lobelia* spp. (lobelias), and *Pachysandra procumbens* (Allegheny-spurge). *Panax quinquefolius* (ginseng) and *Asarum canadensis* (Canadian ginger) rarely occur. Mosses and liverworts are common (Delcourt and Delcourt 1974,1975, LNHP 1986-2004, Martin 1992).

Current Extent and Status:

Currently only about 25 % (50,000 to 100,000 acres) of Louisiana's southern mesophytic forests remain intact (Smith 1993). Clearing for agriculture, timber harvesting and development in West Feliciana Parish brought about loss, degradation, and fragmentation of these forests. The southern mesophytic forest type is extremely susceptible to soil damage, particulary erosion stemming from any form of disturbance, such as logging or road building, that exposes bare soil. In such cases, the very steep slopes and loess soil result in frequent landslides (Quigley and Platt 1996). The largest protected tract of this habitat in Louisiana is found on the Tunica Hills WMA with 5,231 acres. Nearby the OSP manages a site that will open in the near future as a state preservation area, and TNC manages 110 acres on the Mary Ann Brown Preserve southeast of St. Francisville. The Natural Areas Registry Program has several properties registered for a total of 618 acres with another 815 acres proposed for membership in the program.

SOUTHERN MESOPHYTIC FOREST SPECIES OF CONSERVATION CONCERN (24)		
AMPHIBIANS	Worm-eating Warbler	**MAMMALS**
Webster's Salamander	Swainson's Warbler	Southeastern Shrew
Barking Treefrog	Louisiana Waterthrush	Southeastern Myotis
Eastern Spadefoot	Kentucky Warbler	Big Brown Bat
	Hooded Warbler	Louisiana Black Bear
BIRDS	Orchard Oriole	Long-tailed Weasel
American Woodcock		Eastern Spotted Skunk
Yellow-billed Cuckoo	**BUTTERFLIES**	
Wood Thrush	Falcate Orangetip	**REPTILES**
Yellow-throated Vireo	Creole Pearly Eye	Scarlet Kingsnake
Northern Parula		Timber Rattlesnake

Priority Species Research and Survey Needs:

Eastern Spotted Skunk: Considered critically imperiled in Louisiana, intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Long-tailed Weasel: Considered vulnerable in Louisiana. Intensive surveys needed to update occurrence records and abundance for inclusion in the LNHP database.

Songbirds:

- Continue to support research on the effects of silviculture/land management practices on all songbird species.
- Develop longterm monitoring projects that focus on abundances and reproductive success (with emphasis on species of conservation concern) in this habitat type through the establishment of MAPS stations and BBS routes.

Butterflies: Conduct surveys to determine current distribution and abundance of all butterfly species, especially species of conservation concern, for inclusion in the LNHP database.

Conduct habitat use and life history studies for mammal species of conservation concern that may potentially use this habitat.

Document the habitat relationships of priority species to know how dependent they are upon Southern Mesophytic Forest habitats, relative to other habitat types.

Determine the microhabitat preferences and requirements of species occuring in southern mesophytic forests to understand how these species are utilizing the habitat to determine management needs.

Species Conservation Strategies:

1. Timber Rattlesnake: Naturally low-occurring population levels and persecution make persistence tenuous. Prohibit the killing and removal of timber rattlesnakes. Reduce vehicular traffic in sensitive areas.
2. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat				
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Soil Erosion
Conversion to agriculture or other forest types		XXX		XXX	
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX	
Incompatible forestry practices	XXX		XXX		XXX
Invasive/alien species	XXX				
Recreational use/vehicles			XXX		XXX
Residential development		XXX	XXX	XXX	XXX

Habitat Conservation Strategies:

1. Develop partnerships with federal and state agencies, NGO's and others to identify potential parcels of this habitat type for acquisition and conservation.
2. Provide education/outreach to promote conservation and preservation of this habitat type.
3. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
4. Provide loggers and landowners with updated BMPs for harvesting timber in this habitat type.
5. Partner with OSP to design nature/recreational trails for state parks lands and develop similar trails on Tunica Hills WMA.

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33. Spruce Pine-Hardwood Flatwood

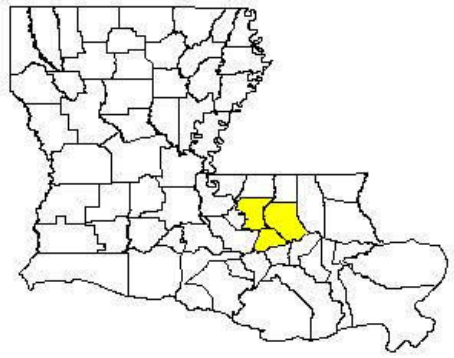
Rarity Rank: S1/G1G2
Synonyms: Pine-Hardwood Flatwoods
Ecological Systems: CES203.557 East Gulf Coastal Plain Southern Loblolly-Hardwood Flatwoods

General Description:

This flatwoods type is a natural mixed forest community indigenous to the western Florida Parishes in southeast Louisiana. A wetland variant of this community occupies poorly drained flats, depressional areas and small drainages (sometimes called "slashes") that lie in a mosaic with higher, non-wetland areas. Such higher areas support a mesic spruce pine-hardwood flatwoods forest. Both variants are distinguished by the prevalence of *Pinus glabra* (spruce pine) over *P. taeda* (loblolly pine), although loblolly is usually present at some level. Hardwoods usually dominate the forest, but spruce pine can dominate areas within the stand. Soils are hydric, acidic silt loams including the Encrow, Gilbert and Springfield series. These soils are significantly higher in nutrient levels than those historically supporting the *P. palustris* (longleaf pine) communities occuping similar hydrologic settings immediately to the east (Smith 1996). This edaphic factor may have precluded longleaf from this community type. Historically fire was probably very rare as the component plant species are not fire adapted and fuel conditions are not conducive to fire. Additional characteristic native tree, shrub and vine species include: *Acer rubrum* (red maple), *Ampelopsis arborea* (peppervine), *Berchemia scandens* (rattan vine), *Brunnichia cirrhosa* (ladies' eardrops), *Campsis radicans* (trumpet creeper), *Carya glabra* (pignut hickory), *Cephalanthus occidentalis* (buttonbush), *Cornus foemina* (swamp dogwood), *Crataegus opaca* (mayhaw), *C. viridis* (greenhaw), *Diospyros virginiana* (persimmon), *Fraxinus caroliniana* (Carolina ash), *F. pennsylvanica* (green ash), *Ilex decidua* (deciduous holly), *I. opaca* (American holly), *Itea virginica* (Virginia willow), *Liquidambar styraciflua* (sweetgum), *Magnolia grandiflora* (Southern magnolia), *Morella cerifera* (wax myrtle), *Nyssa biflora* (swamp blackgum), *N. sylvatica* (blackgum), *Quercus laurifolia* (laurel oak), *Q. michauxii* (swamp chestnut oak), *Q. nigra* (water oak), *Q. pagoda* (cherrybark oak), *Q. phellos* (willow oak), *Toxicodendron radicans* (poison ivy), *Salix nigra* (black willow), *Sambucus canadensis* (elderberry), *Smilax glauca*, *S. rotundifolia*, *Styrax americanus* (snowbell), *Viburnum dentatum* (arrowwood), and *Vitis rotundifolia* (muscadine). Spruce pine-hardwood flatwoods typically have a dense canopy resulting in heavy shading and usually a sparse understory. *Sabal minor* (dwarf palmetto) is often an understory dominant. Other understory natives include: *Arundinaria gigantea* (switchcane), *Boehmeria cylindrica* (hempweed), *Carex* spp. (sedges), *Chasmanthium* spp.

(spikegrasses), *Cyperus* spp. (flatsedges), *Gratiola virginiana* (roundfruit hedgehyssop), *Hygrophila lacustris* (Gulf swampweed), *Hypericum* spp. (St. Andrew's cross), *Juncus* spp. (rushes), *Justicia ovata* (waterwillow), *Ludwigia* spp. (primrose willow) , *Lycopus rubellus* (taperleaf horehound), *L. virginicus* (water horehound), *Lysimachia radicans* (trailing yellow loosestrife, *Onoclea sensibilis* (sensitive fern), *Osmunda regalis* (royal fern), *Panicum gymnocarpon* (savannah panicgrass), *Polygonum* spp. (smartweed), *Rhynchospora* spp. (beaksedge), *Sabatia calycina* (coastal rose gentian), *Saururus cernuus* (lizard's tail), *Schoenoplectus* spp. (bullrushes), *Solidago gigantea* (goldenrod), *Thelypteris palustris* (Southern shield fern), *Triadenum walteri* (greater marsh St. John's wort), *Vernonia gigantea* ssp. *gigantea* (giant ironweed), and *Woodwardia areolata* (netted chain fern).

Current Extent and Status:



Spruce pine-hardwood flatwoods are restricted to Louisiana, occurring in a very narrow range in Livingston, East Baton Rouge and perhaps Ascension Parishes. Presettlement acreage is estimated at 50,000 to 100,000 acres with only 10 % currently remaining (Smith 1993). The predominant threat to this habitat type is conversion to commercial and residential developments due to the rapid expansion of urbanization along the Interstate-12 corridor in the Florida Parishes of Louisiana. Other major factors threatening this association include logging and conversion to commercial pine plantations, and hydrological alterations. Today the remaining spruce pine flatwoods are primarily in private ownership. Only one private tract of 152 acres is registered with the Louisiana Natural Areas Registry Program, and an additional site of unknown acreage is protected within Tickfaw State Park.

SPRUCE PINE – HARDWOOD FLATWOOD SPECIES OF CONSERVATION CONCERN (19)		
AMPHIBIANS	Northern Parula	**MAMMALS**
Southern Dusky Salamander	Prothonotary Warbler	Southeastern Shrew
Four-toed Salamander	Swainson's Warbler	Southeastern Myotis
Gulf Coast Mud Salamander	Hooded Warbler	Long-tailed Weasel
	Rusty Blackbird	
BIRDS	Orchard Oriole	**REPTILES**
American Woodcock		Scarlet Kingsnake
Yellow-billed Cuckoo	**BUTTERFLIES**	Timber Rattlesnake
Wood Thrush	Appalachian Brown	
Yellow-throated Vireo		

Priority Species Research and Survey Needs:

Songbirds: Continued research on the effects of silviculture/land management practices on all songbird species.

Appalachian Brown: Conduct surveys to determine its current distribution and abundance for inclusion in the LNHP database.

Southeastern Shrew: Together with Arkansas and Missour,i Louisiana represents the western edge of its range. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Long-tailed Weasel: Considered vulnerable in Louisiana. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Determine the microhabitat preferences and requirements of target species occuring in spruce pine- hardwood flatwood forests to understand how these species are utilizing the habitat to determine management needs.

Species Conservation Strategies:

1. Four-toed Salamander: Recent Louisiana records are all from Spruce Pine – Hardwood Flatwood forest. Reproduction requires fishless gum ponds. Locate gum ponds and buffer from anthropogenic modification to perpetuate reproduction.
2. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.

Threats Affecting Habitat:
The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat				
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns
Commercial/industrial development		XXX			
Construction of ditches, drainage or diversion systems	XXX		XXX		XXX
Conversion to agriculture or other forest types		XXX		XXX	
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX	
Incompatible forestry practices	XXX		XXX		XXX
Invasive/alien species	XXX				
Residential development		XXX	XXX	XXX	

Habitat Conservation Strategies:

1. Conduct surveys to determine the current extent and condition of this habitat type.
2. Work with appropriate planning commissions to provide them with LNHP data that illustrates locations of this habitat type.
3. Partner with NGOs, OSP, private landowners, etc. to initiate restoration and preservation efforts of spruce pine – hardwood flatwood forests and continue to encourage landowners to enroll this habitat type in the Natural Areas Registry Program.
4. Work with interested groups to promote SFI guidelines and develop new BMPs specific to this habitat. Distribute these guidelines to landowners/land managers through technical pamphlets and the LDWF website.
5. Promote the use of federal cost share programs (NRCS) to control invasive species.
6. Provide education/outreach to promote conservation and preservation of this habitat type with an emphasis on the effects of invasive/exotic plant species (tallow, privet, etc.).
7. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
8. Encourage LDAF and other growers to produce spruce pine seedlings for distribution to landowners interested in restoring this habitat type.
9. Promote controlled access for recreational use/vehicles in this habitat type.

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34. Vegetated Pioneer Emerging Delta

Rarity Rank: S2S3/G3G4
Synonyms: Delta Flats, Emergent Islands
Ecological Systems: CES203.470 Mississippi Delta Fresh and Oligohaline Tidal Marsh

General Description:

Vegetated Pioneer Emerging Delta is a dynamic community forming primarily within the actively building delta region at the mouth of the Atchafalaya River. Zonation of species occurs on the newly accreted land. *Echinochloa walteri* (coast cockspur grass) dominates the higher areas; *Sagittaria latifolia* (broadleaf bulltongue), *S. platyphylla* (delta arrowhead), *Cyperus difformis* (variable flatsedge), *Leptochloa uninervia* (Mexican sprangletop), and *Eleocharis parvula* (dwarf spikerush) dominate the lower zones inundated by daily tides; *Sagittaria platyphylla* (delta arrowhead), *Cyperus difformis* (variable flatsedge), *Leptochloa uninervia* (Mexican sprangletop), *Eleocharis parvula* (dwarf spikerush) and *Bacopa monnieri* (coastal water hyssop) dominate the intermediate zone. Other characteristic vegetation includes *Salix* spp. (willow), *Typha latifolia* (common cattail), *Scirpus validus* (softstem bulrush), *Scirpus americanus* (threesquare bulrush), and *Juncus effusus* (soft rush).

The island soils contain a greater percentage of sand and less moisture than marsh soils. The pioneer ridge vegetation is similar to the sand bars and delta of the Mississippi River while the pioneer marsh vegetation is similar to that of fresh marsh areas. The community is very diverse with as many as 241 species. The pioneer community is successional in nature and changes rapidly with time. The new delta community's ecological functions are similar in nature to marsh and mudflat systems.

Current Extent and Status:

According to Smith (1993) there was an estimated 2,000 to 10,000 acres of vegetated pioneer emerging delta in presettlement times. An estimated 75 to 100 percent is present today.

There are two areas of the Louisiana coast supporting this habitat: the actively forming Atchafalaya Delta and the current mouth of the Mississippi River. In the case of the former area,

newly created delta land is incorporated into Atchafalaya Delta WMA. The WMA is 141,000 acres, and consists of newly formed land and open shallow bay. About 27,000 acres are vegetated land. Land is creatd by natural deltaic processes and by dredge spoil strategically deposited by the COE. Most newly formed land at the mouth of the Mississippi River in Plaquemines Parish is captured in Pass-a-Loutre WMA, which totals 115,000 acres. In addition to delta splays, this total acerage also includes fresh and intermediate marsh. The Mississippi River has been held in its current course for an over-extended period of time and would likely have switched deltas recently. Management activities at Pass-a-Loutre include diverting sediment-laden waters into shallow open water habitat to create new delta land.

VEGETATED PIONEER EMERGING DELTA SPECIES OF CONSERVATION CONCERN (23)		
BIRDS	Lesser Scaup	Short-billed Dowitcher
Brown Pelican	Bald Eagle	Gull-billed Tern
Reddish Egret	Whooping Crane	Caspian Tern
Yellow-crowned Night-Heron	Snowy Plover	Royal Tern
Mottled Duck	Wilson's Plover	Sandwich Tern
Northern Pintail	Piping Plover	Common Tern
Canvasback	Marbled Godwit	Forster's Tern
Redhead	Dunlin	Black Skimmer

Priority Species Research and Survey Needs:

Brown Pelicans: Large populations should be monitored on a scheduled basis to detect long-term trends and to guide management decisions.

Reddish Egret: Surveys are needed to assess the limiting factors of reproductive success and the effects of human coastal recreational activities on egret populations.

Piping Plovers: Conduct long term winter surveys to monitor yearly abundance patterns.

Shorebirds and Terns: Initiate surveys to determine species use of this habitat and develop management recommendations for inclusion in future coastal restotarion plans.

Species Conservation Strategies:

1. Shorebirds, Wading Birds:
   - Provide public education regarding the importance of waterbird nesting colonies and shorebird feeding areas. Reduce the negative effects on these areas from recreational and other uses.
   - Coordinate with GCJV to implement recommendations of shorebird and wading bird conservation plans.
2. Brown Pelican: Continue with long-term monitoring of nesting colonies.
3. Bald Eagle: Continue with long-term monitoring of active bald eagle nests, successful breeding pairs, and fledged eagles.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat				
Source of Threat	Altered Composition/ Structure	Habitat Disturbance	Herbivory	Modification of Water Levels; Changes in Natural Flow Patterns	Salinity Alteration
Channelization of rivers or streams	XXX			XXX	
Invasive/alien species	XXX		XXX		
Operation of drainage or diversion systems				XXX	
Recreational use/vehicles		XXX			
Saltwater intrusion					XXX

Habitat Conservation Strategies:

1. Identify and protect sensitive areas from disturbances such as boats or other motorized vehicles and recreational use. Limit human access to this habitat type.
2. Work with COE to develop better strategies for the placement of dredge materials as a restoration method for this habitat type. Promote appropriate use of dredge spoil to develop new areas for nesting sites, general stopover sites, and to enhance aquatic species habitat.
3. Work with COE, LDNR, and other interested groups to develop improved management techniques for this habitat type.
4. Work with COE and others to manage water control to create more high quality habitat and benefit existing delta habitat.
5. Work with LCA, CWPPRA, NRCS to incorporte management objectives for the protection and restoration of emerging delta habitat.

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35. Western Hillside Seepage Bog

Rarity Rank: S2/G2G3
Synonyms: Pitcher Plant Bog, Herbaceous Bog, Bog, Hillside Seep, Hillside Bog
Ecological Systems: CES203.194 West Gulf Coastal Plain Herbaceous Seepage Bog

General Description:

Hillside seepage bogs are open, mostly treeless, herb-dominated natural wetlands of hilly, sandy uplands historically dominated by *Pinus palustris* (longleaf pine) of the East and West Gulf Coastal Plains in Louisiana. In the WGCP, these bogs occur on the Pleistocene high and intermediate terraces and on Tertiary uplands (Catahoula, Fleming, and Sparta formations). They occur commonly on mid- to low slopes, on saturated, strongly acidic (pH ca. 4.5 - 5.5) and nutrient-poor substrates of fine sandy loams or loamy fine sands with relatively high organic matter content (Smith 1996). Soil series names have generally not been assigned to bogs due to the naturally very limited acreage in the state (Smith 1996).

These bogs are generally persistently wet from seepage, and are variable in size being most often less than 1 acre but rarely exceeding 10 acres. WGCP bogs are underlain by an impervious clay or sandstone layer that, when conditions are right, causes ground water to constantly seep to the soil surface. The herbaceous groundcover is dense, continuous and floristically rich. It is dominated by sedges, grasses and grass-like plants, and many kinds of unusual forbs, including pitcher-plants (*Sarracenia* alata) and a variety of orchid species. Patches of shrubs are often present within bogs, and can become more prevelant, possibly degrading the habitat, if fire is excluded from the system. Since hillside bogs are embedded in what are now or historically were longleaf pine forests, they are fire-driven systems. They evolved with frequent growing-season fire events. Among other things, frequent fire deters invasion by shrubs and trees and stimulates growth, flowering and seed production by indigenous bog herbs (Barker 1980).

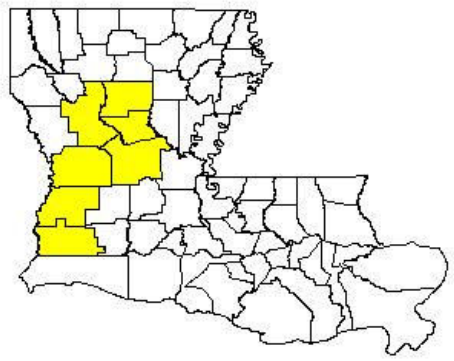
The degree to which a bog remains wet throughout the year depends on the size of the watershed, the soil infiltration rate upslope, the rate of saturated flow in the soil, the topographic position of the bog, the bog's water storage capacity, and the rate of water leaving the bog from evapo-transpiration and through surface and sub-surface flow. In general, the greater the infiltration rate of the watershed soils and the water holding capacity of bog soils, the smaller the recharge area needed to maintain seepage throughout dry periods of the year. Therefore, bogs are extremely sensitive to

surrounding land management activities, and are easily degraded or destroyed by activities that alter natural hydrologic regimes.

Hillside seepage bogs are rich in herbaceous plant species, primarily grasses and grass-like plants (graminoids), although a large variety of forbs is present. There appears to be a distinct relationship between the number of species present and bog (MacRoberts and MacRoberts 1992, 1993). More than 100 plant species may be found in a relatively large bog (MacRoberts and MacRoberts 1988). Many species are restricted to this habitat and closely allied longleaf pine flatwood savannahs.

Vegetation dominants include: *Andropogon* spp. (bluestems), *Aristida* spp. (threeawn grasses), *Panicum* spp. (panic grasses), *Ctenium aromaticum* (tooth-ache grass), *Muhlenbergia capillaris* (hairawn muhly), *Rhynchospora* spp. (beak-rushes), *Rhynchospora stenophylla* (narrow-leaved beakrush, S1G4), *Xyris* spp. (yellow-eyed grasses), *Eriocaulon* spp. (pipeworts), *Lachnocaulon* spp. (bog buttons), *Dichromena latifolia* (giant white top sedge), *Scleria* spp. (nut-rushes), *Fuirena* spp. (umbrella grasses), and *Fimbristylis* spp. (fimbry-sedge). Primary forbs include *Sarracenia alata* (green pitcher plant), *Rhexia* spp. (meadow beauties), *Polygala* spp. (milkworts), *Liatris* spp. (blazing stars), *Aletris lutea* (colic-root), *Eupatorium* spp. (thorough-worts), *Coreopsis linifolia* (narrow-leaved tickseed), *Drosera* spp. (sundews). Many rare forbs are found in EGCP bogs including *Sarracenia psittacina* (parrot pitcherplant, S3G4), *Pinguicula lutea* (yellow butterwort, S2G4G5), *Lilium catesbaei* (southern red lily, S1G4), *Tofieldia racemosa* (coastal false-asphodel, S2S3G5), *Lophiola aurea* (golden crest, S2S3G4), and *Macranthera flammea* (flame flower, S2G3). Various orchids, especially *Platanthera* spp. (fringed orchids), are often conspicuous members of the flora. Ferns (principally *Osmunda* spp.) and club-mosses (*Lycopodium* spp.) are usually present and sphagnum moss is often abundant (LNHP 1986-2004, MacRoberts and MacRoberts 1988, 1993a, 1993b, 1991).

Current Extent and Status:



In the WGCP hillside seepage bogs are found from Calcasieu north to Natchitoches and Winn Parishes. There are many known for Vernon and Natchitoches probably due to KNF and Ft. Polk and the superior habitat conditions on those areas plus the ease of access to conduct surveys. There are probably many in Beauregard Parish. The habitat is rare in Calcasieu Parish and restricted to the extreme northern part of the parish. There is one known non-*Sarracenia* bog in each of Grant and Rapides Parishes and they are both poorly developed. There are a handful of bogs known in northern Winn Parish and these currently represent the northern most bogs in Louisiana.

This habitat overall has good viability in the WGCP, owing to the many protected occurrences on KNF and Ft. Polk. There are likely many examples on private land that are degraded (mainly by fire supression) but recoverable, especially in Beauregard Parish.

WESTERN HILLSIDE SEEPAGE BOG SPECIES OF CONSERVATION CONCERN (5)		
BIRDS	**BUTTERFLIES**	**CRUSTACEANS**
Sedge Wren	Arogos Skipper	Pine Hills Crawfish
Henslow's Sparrow		
Le Conte's Sparrow		

Priority Species Research and Survey Needs:

Sedge Wren, Henslow's Sparrow, Le Conte's Sparrow: Continue to inventory and monitor the status of these species and their habitat on public and private lands to fill data gaps in species distribution and abundance for inclusion in the LNHP database and Audubon nationwide database.

Arogos Skipper: Conduct surveys to determine its current distribution and abundance for inclusion in the LNHP database.

Examine the demographics, habitat-use patterns, and impacts of feral hogs on ground nesting birds, salamanders, and small mammals (Warren and Ford 1997).

Species Conservation Strategies:

1. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.
2. Examine the demographics, habitat-use patterns, and impacts of feral hogs on ground nesting birds, salamanders and small mammals (Warren and Ford 1997).
3. Implement conservation and management recommendations of SWG projects T22 and T32 upon completion.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat: Altered Composition/ Structure	Threat: Habitat Disturbance	Threat: Modification of Water Levels; Changes in Natural Flow Patterns
Fire suppression	XXX		
Incompatible forestry practices	XXX	XXX	XXX
Invasive/alien species	XXX	XXX	
Recreational use/vehicles	XXX	XXX	

Habitat Conservation Strategies:

1. Conduct surveys to determine the extent and condition of this habitat type with a focus on identifying the surrounding landscape context (i.e., residential developments, etc.) that might be affected by prescribed burning.
2. Once bogs are identified, conduct landowner surveys to aid in the development of management strategies for these sites.
3. Continue to encourage landowners to implement BMPs and adopt SFI standards in the management of this habitat type.
4. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots in this habitat type.
5. Promote the utilization of federal cost share programs (NRCS) to address invasive species problems.
6. Provide additional cost share funds for landowners to drastically reduce or eliminate the costs associated with conducting prescribed burns on their property.
7. Provide education/outreach to promote conservation and preservation of this habitat type.
8. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
9. Work with appropriate planning commissions to provide them with LNHP data that illustrates locations of this habitat type.
10. Develop strategies to address damage from feral hogs within this habitat type.

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36. Western Longleaf Pine Savannah

Rarity Rank: Acidic - S1S2/G2G3; Saline - S1/G1; Flatwoods Pond - S1/G2Q
Synonyms: Open Savannah, Pine Flatwoods, Coastal Meadow, Pine Meadow, Pine Barren
Ecological Systems: CES203.547 West Gulf Coastal Plain Flatwoods Pond
CES203.191 West Gulf Coastal Plain Wet Longleaf Pine Savannah and Flatwoods

***General Description*:**

(Note: Western Longleaf Pine Savannah includes both the Acidic savannah type (S1S2), and Saline savannah type (S1), and are combined due to similarities in management strategies. The Flatwoods Pond (S1) natural community type occurs as small inclusions within the Western Longleaf Pine Savannahs, and therefore is combined with the savannahs.)

Pine savannahs are floristically rich, herb-dominated wetlands, that are naturally sparsely stocked with *Pinus palustris* (longleaf pine). They historically dominated the Gulf Coastal Plain flatwood regions of southeast and southwest Louisiana. The term "savannah" is classically used to describe expansive herb-dominated areas with scattered trees. Wet savannahs occupy the poorly drained and seasonally saturated/flooded depressional areas and low flats, while the non-wetland flatwoods occupy the better drained slight rises, low ridges and "pimple mounds" (only WGCP). Pine savannahs are subject to a highly fluctuating water table, from surface saturation/shallow flooding in late fall/winter/early spring to growing-season droughtiness. Soils are hydric, very strongly acidic, nutrient poor, fine sandy loams and silt loams, low in organic matter. There is a western Louisiana variant on saline soil (Brimstone silt loam). The soils for both eastern and western types may be underlain by an impeding layer so that they are only slowly permeable and water runs off the surface gradually.

Common woody species include *Pinus palustris* (usually predominant tree species), *Magnolia virginiana* (sweet bay), *Nyssa sylvatica* (black gum), *Quercus virginiana* (live oak), *Q. marilandica* (blackjack oak), *Q. laurifolia* (laurel oak), *Cyrilla racemiflora* (swamp cyrilla), *Morella* spp. (wax myrtles), *Hypericum* spp. (St. John's worts), and *Styrax americana* (littleleaf snowbell). Although past logging has altered the arboreal characteristics of most occurrences of the community (primarily by reducing coverage of longleaf pine), the herbaceous complement is thought to differ little from that present

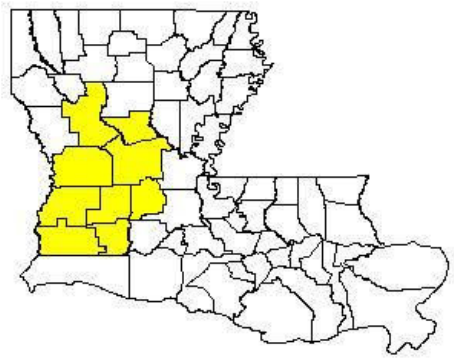
prior to timbering and stumping activities. Herbaceous vegetation of pine savannahs is very diverse, dominated by graminoids, and similar to that occurring in hillside bogs. Graminoids present include *Andropogon* spp. (broomsedges), *Schizachyrium scoparium* and *S. tenerum* (little and slender bluestem), *Panicum* spp. (panic grasses), *Aristida* spp. (three-awn grasses), *Ctenium aromaticum* (toothache grass), *Muhlenbergia expansa* (hairawn muhly), *Erianthus* spp. (plume-grasses), *Coelorachis* spp. (jointgrasses), *Rhynchospora* spp. (beak-rushes), *Xyris* spp. (yellow-eyed grasses), *Fuirena* spp. (umbrella grasses), *Scleria* spp. (nut-rushes), *Dichromena latifolia* (giant white top sedge), *Eriocaulon* spp. (pipeworts), *Lachnocaulon* spp. (bog buttons), and *Fimbristylis* spp. (fimbry-sedge). Some forbs common in the community include *Agalinis* spp. (gerardias), *Lobelia* spp. (lobelias), *Rhexia* spp. (meadow beauties), *Eryngium integrifolium* (bog thistle), *Oxypolis filiformis* (narrow-leaved hog-fennel), *Polygala* spp. (milkworts), *Liatris* spp. (blazing-stars), *Sabatia* spp. (rose-gentians), *Drosera* spp. (sundews), *Pinguicula* spp. (butterworts), *Marshallia tenuifolia* (thin-leaved barbara's-buttons, southwestern Louisiana), *Utricularia* spp. (bladderworts), and *Platanthera* spp. (fringed-orchids). The only known extant occurrence of *Schwalbea americana* (American chaffseed), which is federally-listed as endangered, is found on pimple mounds in a longleaf pine savannah in Allen Parish. This species is known historically from Calcasieu and Rapides Parishes. Various additional species belonging to the lily family (Liliaceae), sunflower family (Asteraceae), and orchid family (Orchidaceae) are prominent. *Lycopodium* spp. (club-mosses) and sphagnum moss are often abundant. Fire frequency is a major factor controlling species occurrence and community structure. Without frequent fire (preferably growing season burns which mimic historic fire regimes), shrubs, and eventually trees, especially hardwoods, would gain dominance and eliminate most of the herbaceous flora.


Schwalbea americana

Flatwoods Ponds are relatively small, natural depressional wetlands embedded within current or historic longleaf pine flatwoods/savannahs of western Louisiana. They are believed to occupy swales and depressions remaining from ancient Pleistocene stream channels, and are often linear in shape, although circular and elliptic ponds are common. Their size ranges from less than 1 acre up to about 30 or 40 acres, but average 1 to 5 acres. In general, small ponds are relatively shallow, while larger ponds are deeper. They may range from just a few inches deep relative to surrounding pine flats, to approximately 5 feet deep in deeper, larger ponds. Generally treeless, these ponds are vegetated by a variety of obligate and facultative wetland

herbaceous species, mainly tall sedges and grasses. Native herbaceous species that usually characterize shallow ponds or edges of deeper ponds include: *Andropogon glomeratus* var. *glaucopsis* (bushy beardgrass), *Aristida palustris* (= *A. affinis*) (longleaf three-awn grass), *Coreopsis linifolia* (tickseed), *Eleocharis tuberculosa* (spikerush), *Eriocaulon decangulare* (pipewort), the beakrushes - *Rhynchospora filifolia*, *R. gracilenta*, *R. rariflora*, and *Dichromena latifolia*, *Gratiola brevifolia* (hyssop), *Hypericum galioides* (St. John's wort), *Hyptis alata* (bitter mint), *Panicum virgatum* (switchgrass), *Pluchea rosea* (stinkweed), *Polygala ramosa* (candyroot), *Proserpinaca pectinata* (mermaid-weed), *Hibiscus aculeatus* (comfort-root), and *Rhexia lutea* (meadow beauty). Deep ponds are characterized by a variable mix of herbs, including: *Amsonia glaberrima* (bluestar), *Bacopa caroliniana* (blue-hyssop), *Carex verrucosa*, *Dichanthelium* spp., *Hibiscus moscheutos* ssp. *lasiocarpus*, *Juncus effuses* (soft rush), *Ludwigia pilosa* (evening primrose), *Lycopus rubellus* (bugleweed), *Oxypolis filiformis* (hog-fennel), *Panicum hemitomon* (maidencane), *Panicum virgatum* (switchgrass), beakrushes – *Rhynchospora cephalantha* and *R. corniculata*, and *Sagittaria graminea* (arrowhead). Trees, often appearing stunted, may be present in deeper, more frequently flooded, and therefore less fire-exposed parts of ponds. Tree and woody species may include: *Nyssa biflora* (swamp blackgum), *Acer rubrum* (red maple), *Cephalanthus occidentalis* (buttonbush), *Styrax americanus* (small snowbell), *Crataegus opaca* (mayhaw), and *Morella cerifera* (waxmyrtle). The hydrologic regime of these ponds is characterized by a seasonally fluctuating water level – dry in summer and flooded the other 3 seasons. This water level fluctuation causes distinct vegetation zones with species sorting out according to their relative tolerance or competitive adaptations to flooding and saturated soil conditions. Flatwood ponds were historically maintained by frequent lightening generated fires that, every few years, swept the longleaf pine flats in which flatwoods ponds are embedded. Such fires burned the ponds during the late spring/summer dry season, killing back encroaching shrubs and trees and rejuvenating the herbaceous ground cover.

Current Extent and Status:



Western longleaf flatwoods savannahs and imbedded communities are highly threatened and much reduced from their original extent. This habitat is estimated to have occupied 1,000,000 to 2,000,000 acres in presettlement times with and estimated 1 to 5 percent remaining (Smith 1993). Threats include conversion to slash or loblolly pine plantations, residential/commercial development, fire exclusion/inappropriate fire regime, hydrological alterations (to include adjacent areas), contamination by chemicals (herbicides, fertilizers), and physical damage from timber harvesting/planting activities (Smith 1996).

There are very few high quality examples of longleaf pine savannahs and they tend to be isolated on the landscape. Protected examples occur on KNF and there are several on private land. A high quality acidic savannah is being protected by TNC on their CC Road Savannah Preserve in Allen Parish, which totals 468 acres. TNC is also protecting a saline variant on their Persimmon Gully Preserve in Calcasieu Parish. Persimmon Gully is a 255-acre preserve. An additional 40 acres of saline longleaf pine savannah in Calcasieu Parish are being protected by a forest products company. Several longleaf savannahs on private tracts are registered as Natural Areas. Barnes Creek Savannah Natural Area, in Allen Parish, totals 680 acres and supports a good quality acidic savannah with several flatwoods ponds. In the same part of Allen Parish, Parkers Longleaf Natural Area supports a savannah and totals 160 acres. There are several more sites in southwest Louisiana, some of which being as large as several hundred acres, that support high quality longleaf pine savannah habitat. These sites should be considered a conservation priority.

WESTERN LONGLEAF PINE SAVANNAH SPECIES OF CONSERVATION CONCERN (23)		
AMPHIBIANS	Red-cockaded Woodpecker	**BUTTERFLIES**
Eastern Tiger Salamander	Scissor-tailed Flycatcher	Reakirt's Blue
Southern Crawfish Frog	Brown-headed Nuthatch	Little Metalmark
	Sedge Wren	
BIRDS	Loggerhead Shrike	**MAMMALS**
Northern Harrier	Bachman's Sparrow	Hispid Pocket Mouse
Northern Bobwhite	Field Sparrow	Eastern Harvest Mouse
Yellow Rail	Henslow's Sparrow	
American Woodcock	Le Conte's Sparrow	**REPTILES**
Yellow-billed Cuckoo		Western Slender Glass Lizard
Chuck-Will's-Widow		Southeastern Scarlet Snake

Priority Species Research and Survey Needs:

Northern Bobwhite: Populations have declined precipitously from 1980-1999, averaging 8.2% per year in BCR 25; 6.0% per year in BCR 26; 5.8% per year in BCR 27; 4.5% per year in BCR 37. Continue to monitor populations thru breeding bird and hunting surveys.

Bachman's Sparrow: Intensive surveys are needed to produce estimates of current population size statewide. Develop projects which determine the relationship between population size and vegetation succession on quality sites. Determine whether management activities can create a mosaic of adjacent sites that together provide continuously occupied habitat. Determine dispersal behavior to maximize the benefits/effects of future habitat management.

Henslow's Sparrow: Obtain more information on winter habitat abundance, distribution, and habitat needs throughout Louisiana.

Eastern Harvest Mouse: Considered vulnerable in Louisiana. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Hispid Pocket Mouse: Louisiana represents the eastern edge of its range. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Determine the microhabitat preferences and requirements of species occuring in western longleaf pine savannahs to understand how these species are utilizing the habitat to develop management recommendations for these species.

Species Conservation Strategies:

1. Southern Crawfish Frog: Difficult to detect, with very few recent records. Breeds in fishless, vernal ponds/gum ponds. Locate and buffer potential breeding sites.

2. Red-cockaded Woodpecker:
   - Continue to support the implementation of the Louisiana Statewide RCW Safe Harbor Program.
   - Support USFWS recovery efforts outlined in the RCW recovery plan, 2nd Revision.
   - Encourage the establishment of new RCW populations.
   - Investigate potential land acquisition of this habitat type to increase and support new RCW populations

3. Henslow's Sparrow, Bachman's Sparrow:
   - Implement conservation and management recommendations of SWG projects T22 and T32 upon completion.
   - Monitor reproductive success of Bachman's sparrows to determine limiting factors.
   - Work with landowners to encourage the use of BMPs for prescribed fire management and timber harvesting techniques to improve habitat quality.

4. Northern Bobwhite and Grassland Birds: Support implementation of recommended habitat restoration actions specified in NBCI and by LDWF Quail and Grassland Bird Task Force.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

	Threat				
Source of Threat	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns
Commercial/industrial development		XXX		XXX	
Conversion to agriculture or other forest types		XXX		XXX	
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX	XXX
Fire suppression	XXX			XXX	
Incompatible forestry practices	XXX		XXX		XXX
Invasive/alien species	XXX				
Residential development		XXX	XXX	XXX	

Habitat Conservation Strategies:

1. Conduct surveys to determine the extent and condition of this habitat type with a focus on identifying the surrounding landscape context (i.e., residential developments, etc.) that might be affected by prescribed burning.
2. Educate landowners, adjacent residents, developers, and the general public about the crucial role of prescribed burning in the management of longleaf pine ecosystems (multi-agency, multi-group effort).
3. Provide additional cost share funds through programs such as FLEP in order to drastically reduce or eliminate landowners' costs associated with conducting prescribed burns their property.
4. Develop educational information regarding the importance of ephemeral ponds for species of concern, and make this info available to landowners/land managers through technical pamplets and the LDWF website.
5. Once savannahs are identified conduct landowner surveys to aid in the development of management strategies for these sites.
6. Encourage longer longleaf pine rotation ages when compatible with the landowner's management objectives.
7. Investigate the availability of additional cost-share funding opportunities, through FLEP, Forest Productivity Program (FPP) or other programs, for landowners to reduce the cost of longleaf pine management.
8. Promote advantages of growing longleaf pine and associated herbaceous ground cover.

9. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots in this habitat type.
10. Promote utilization of state and federal cost share programs (FLEP and NRCS programs) to address invasive species problems.
11. Work with the Longleaf Alliance to incorporate their strategies for longleaf pine management and restoration into current restoration efforts.
12. Work with appropriate planning commissions to provide them with LNHP data that illustrates locations of this habitat type.
13. Encourage a university curriculum that incorporates the identification of sensitive natural areas into student studies (especially landscape architecture and courses for planners).

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37. Western Upland Longleaf Pine Forest

Rarity Rank: S2S3/G2G3
Synonyms: Sandhill Pine Forest, Clayhill Pine Forest
Ecological Systems:
CES203.293 West Gulf Coastal Plain Upland Longleaf Pine Forest and Woodland

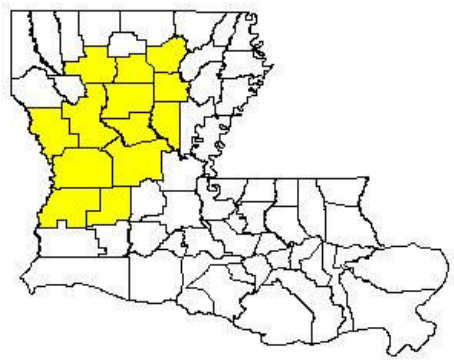
General Description:

This habitat occurs in the hilly uplands in western and central Louisiana. It occurs on acidic loamy sands to acid clays associated with Pleistocene or Tertiary formations. The community is characteristically dissected by small to large branch or creek bottoms. *Pinus palustris* (longleaf pine) is the dominant overstory species, and in locations where fire has frequently occurred, it is often the only canopy species. Where fire is less frequent or suppressed, a number of overstory associates may occur, including *Pinus echinata* (shortleaf pine), *Pinus taeda* (loblolly pine), *Nyssa sylvatica* (black gum), *Liquidambar styraciflua* (sweetgum), *Quercus falcata*, *Q. stellata* (post oak), *Q. marilandica* (blackjack oak), *Q. shumardii* (shumard oak), *Q. alba* (white oak), *Q. nigra* (water oak), *Prunus serotina* (black cherry), *Carya tomentosa* (mockernut hickory), *C. texana* (black hickory, central Louisiana), *Acer rubrum* (red maple), *Diospyros virginiana* (persimmon), and *Sassafras albidum* (sassafras). In sandy soils, *Q. incana* (bluejack oak) and *Q. hemisperica* (upland laurel oak) are frequent associates. Significant shrub species include *Cornus florida* (flowering dogwood), *Vaccinium arboreum* (winter honeysuckle), *V. elliottii* (elliott's blueberry), *V. stamineum* (deer berry), *V. darrowii* (dwarf blueberry, southeast Louisiana), *Gaylussacia dumosa* (dwarf huckleberry, southeast Louisiana), *Callicarpa americana* (French mulberry), *Morella cerifera* (wax myrtle), *Bumelia lanuginosa* (chittum-wood), *Ilex vomitoria* (yaupon), *I. opaca* (American holly), *Rubus* spp. (blackberries), and *Rhus copallina* (winged sumac). Common vines include *Vitis* spp. (grapes), *Smilax* spp. (greenbriers), *Parthenocissus quinquefolia* (Virginia creeper), and *Gelsemium sempervirens* (yellow jessamine). The herbaceous flora may be exceedingly diverse if fire has frequently occured. Grasses, composites, and legumes are predominant in the gound layer. *Andropogon* spp. (broomsedges) and *Schizachyrium* spp. (bluestems) are usually the dominant grasses, but several other genera are usually present, including *Aristida* (three-awn grasses), *Sporobolus* (dropseeds), *Panicum* (panic grasses), *Anthaenantia* (silky scales), *Ctenium aromaticum* (toothache grass), *Digitaria* (crab grasses), *Eragrostis* (love grasses), *Erianthus* (plume grasses), *Gymnopogon* (skeleton grasses), *Muhlenbergia* (muhly grasses), *Paspalum* (paspy grasses), and *Setaria* spp. (bristle grasses). Composites include *Eurybia* spp. and *Symphyotrichum* spp. (asters), *Carphephorus odoratissimus*

(vanilla plant), *Chrysopsis* spp. (golden asters), *Heterotheca* spp. (golden asters), *Elaphantopus* spp. (elephant-foot), *Eupatorium* spp. (thoroughworts), *Euthamia* spp. (flat-topped goldenrods), *Gnaphalium* spp. (rabbit tobaccos), *Helenium* spp. (sneeze-weeds), *Helianthus* spp. (sunflowers), *Liatris* spp. (blazing-stars), *Rudbeckia* spp. (brown-eyed susans), *Solidago* spp. (goldenrods), and *Vernonia* spp. (ironweeds). Prominent legumes are *Baptisia* spp. (indigos), *Cassia* spp. (partridge-peas), *Centrosema virginianum* (butterfly pea), *Clitoria mariana* (pigeon wings), *Crotolaria* spp. (rattle pods), *Desmodium* spp. (beggar's ticks), *Lespedeza* spp. (bush clovers), *Stylsanthes biflora* (pencil-flower), *Rhynchosia* spp. (snout beans), and *Tephrosia* spp. (hoary peas). Additional frequent forbs include *Oenothera* spp. (evening primroses), *Polygala* spp. (milkworts), *Lobelia* spp. (lobelias), *Callirhoe papaver* (poppy-mallow), *Ruellia* spp. (wild petunias), *Hypoxis* spp. (yellow-eyed grasses), *Asclepias* spp. (mildweeds), *Lechea* spp. (pinweeds), *Euphorbia* spp. (spurges), *Sabatia* spp. (rose-gentians), *Agalinis* spp. (false foxgloves), and *Rhexia* spp. (meadow beauties). The fern *Pteridium aquilinum* (bracken fern) is often conspicuous in large colonies.

Current Extent and Status:

Western upland longleaf pine forests historically dominated large areas in the LWGCP. However much of this area has been converted to other forest types or developed. The estimated presettlement acreage of this habitat is 2,000,000 to 4,000,000 with an estimated 10 to 25 % remaining (Smith 1993). While much of this habitat has been lost or altered, there are a number of high quality occurences, particularly on KNF, Ft. Polk, and Peason Ridge Military Reservation (Grace and Smith 1995, Hart and Lester 1993, Martin and Smith 1991, 1993).



WESTERN UPLAND LONGLEAF PINE FOREST SPECIES OF CONSERVATION CONCERN (32)		
AMPHIBIANS	Loggerhead Shrike	**MAMMALS**
Eastern Tiger Salamander	Prairie Warbler	Southeastern Myotis
Louisiana Slimy Salamander	Bachman's Sparrow	Silver-haired Bat
Southern Red-backed Salamander	Field Sparrow	Big Brown Bat
Southern Crawfish Frog	Henslow's Sparrow	Ringtail
	Le Conte's Sparrow	Long-tailed Weasel
BIRDS		
Northern Bobwhite	**BUTTERFLIES**	**REPTILES**
American Woodcock	Wild Indigo Duskywing	Western Slender Glass Lizard
Yellow-billed Cuckoo	Dusted Skipper	Southern Prairie Skink
Red-cockaded Woodpecker	Pepper and Salt Skipper	Southeastern Scarlet Snake
Brown-headed Nuthatch	Falcate Orangetip	Louisiana Pine Snake
Sedge Wren	Harvester	
Wood Thrush	Little Metalmark	

Priority Species Research and Survey Needs:

Brown-headed Nuthatch: Investigate the impacts of silviculture/land management practices on this species and the causes of this species' decline.

Loggerhead Shrike: BBS data for the period 1966-2000 indicate a 71% population decline rangewide. Monitoring of this species reproductive success and the effects of pesticides in reducing food availability are needed along with a statewide evaluation of changes in available habitat.

Songbirds:

- Continue to support research on the effects of silviculture/land management practices on all songbird species.
- Develop longterm monitoring projects that focus on species abundances and reproductive success (with emphasis on species of conservation concern) in this habitat type through the establishment of MAPS stations and BBS routes.

Butterflies: Conduct surveys to determine the current distribution and abundance of all butterfly species, especially species of conservation concern, for inclusion in the LNHP database.

Bats:

- Develop projects that target species of conservation concern and focus on their distribution, abundance, and ecological needs in this habitat type (Lacki and Schwierjohann 2001).
- Research the genetic identities of different Myotis species in the state (Leberg 2004).

Ringtail: Louisiana represents the eastern edge of its range. Intensive surveys are needed to determine its current status in Louisiana.

Long-tailed Weasel: Considered vulnerable in Louisiana. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Louisiana Pine Snake: The quality of remaining habitat has been degraded due to logging, fire suppression, short-rotation silviculture, and conversion to pasture lands. Some of the best remaining populations occur on industrial forest lands. Continue to support research into this species life history, limiting factors that reduce reproductive success, and the use of herbicides instead of prescribed burning on composition and/or density of ground cover vegetation and its effects on pocket gophers.

Species Conservation Strategies:

1. Northern Bobwhite and Grassland Birds: Support the implementation of recommended habitat restoration actions specified in NBCI and by LDWF Quail and Grassland Bird Task Force.

2. Red-cockaded Woodpecker:
   - Continue to support implementation of the Louisiana Statewide RCW Safe Harbor Program.
   - Support USFWS recovery efforts outlined in the RCW recovery plan, 2nd Revision.
   - Encourage the establishment of new RCW populations.
   - Investigate potential land acquisition of this habitat type to increase and support new populations.
3. Brown-headed Nuthatch: Encourage landowners to use group-selection and single-tree selection harvesting methods and maintain or increase the number of standing snags.
4. Henslow's Sparrow, Bachman's Sparrow:
   - Implement conservation and management recommendations of SWG projects T22 and T32 upon completion.
   - Monitor reproductive success of Bachman's sparrows to determine limiting factors.
   - Work with landowners to encourage the use of BMPs for prescribed fire management and timber harvesting techniques to improve habitat quality.
5. Western Slender Glass Lizard, Louisiana Pine Snake:
   - Continue to work with timber industry, USFS, and USFWS to promote habitat and species conservation strategies to increase populations on quality sites.
   - Implement conservation and management recommendations of SWG project T10 upon completion.
6. Promote the use of appropriate silvicultural techniques to restore/manage western upland longleaf pine forests for wildlife (include importance of tree species diversity, den trees for birds and mammals, leaf litter, etc).
7. Promote snag retention during logging operations to increase the numbers available for cavity-nesting species.
8. Develop management recommendations to maintain sufficient levels of woody debris in stands for reptiles, amphibians, and small mammals.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat: Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Conversion to agriculture or other forest types		XXX		XXX
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX
Fire suppression	XXX			XXX
Incompatible forestry practices	XXX		XXX	
Invasive/alien species	XXX			
Oil or gas drilling		XXX	XXX	
Recreational use/vehicles			XXX	

Habitat Conservation Strategies:

1. Conduct surveys to determine the extent and condition of this habitat type with a focus on identifying the surrounding landscape context (i.e., residential developments, etc.) that might be affected by prescribed burning.
2. Encourage longer rotation ages when compatible with the landowner's management objectives.
3. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots in this habitat type.
4. Educate landowners, adjacent residents, developers, and the general public about the crucial role of prescribed burning in the management of longleaf pine ecosystems (multi-agency, multi-group effort).
5. Promote advantages of growing longleaf pine and associated herbaceous ground cover.
6. Promote utilization of state and federal cost share programs (FLEP and NRCS programs) to address invasive species problems.
7. Promote value-added products produced from longleaf pine to encourage landowners to replant longleaf pine instead of off-site pine species.
8. Provide additional cost share funds through programs such as FLEP in order to drastically reduce or eliminate landowners' costs associated with conducting prescribed burns their property.
9. Investigate the availability of additional cost-share funding opportunities, through FLEP, FPP or other programs, for landowners to reduce the cost of longleaf pine management.
10. Work with the Longleaf Alliance to incorporate their strategies for longleaf pine management and restoration into current restoration efforts.

11. Work with appropriate planning commissions to provide them with LNHP data that illustrates locations of this habitat type.

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38. Western Xeric Sandhill Woodland

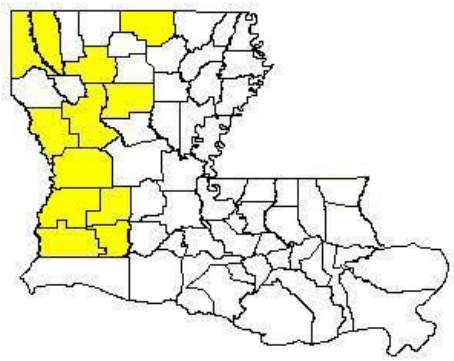
Rarity Rank: S2S3 (S1 - Florida Parishes)/G2G3
Synonyms: Oak-Farkleberry Sandy Lands
Ecological Systems: CES203.056 West Gulf Coastal Plain Sandhill Oak and Shortleaf Pine Forest and Woodland

General Description:

Western Xeric Sandhill Woodlands develop on deep Tertiary marine sands (particularly of the Sparta formation in northwest Louisiana) and also on Pleistocene stream terraces. The soil is nutrient-poor and dries quickly. Trees are often stunted because of extreme site conditions. Fire is thought to be an important process in maintaining this communtiy. However some xeric sandhill woodlands may be isolated by landscape features which make them less subject to fire (e.g., nearly surrounded by a floodplain). This community may have the appearance of a scrubby shrub-woodland. Small, natural openings may be scattered.

Overstory species may include *Pinus echinata* (shortleaf pine), *Pinus taeda* (loblolly pine), *Quercus stellata* (post oak), *Q. marilandica* (blackjack oak), *Q. incana* (bluejack oak), *Q. stellata* var. *margaretta* (sand post oak), and *Q. hemispherica* (upland laurel oak). Shrub species may include *Asimina parviflora* (dwarf paw-paw), *Vaccinium arboreum* (winter huckleberry, may be dominant), *Bumelia lanuginosa* (chittum-wood), *Ilex vomitoria* (yaupon), *Chionanthus virginicus* (fringe-tree), *Rhamnus caroliniana* (Indian cherry), *Polygonella americana*. (jointweed), *Stillingia sylvatica* (stillingia), and *Hamamelis virginiana* (witch-hazel). The herbaceous layer is sparsely developed, but may include *Opuntia humifusa* (prickly-pear cactus), *Andropogon* spp. (broomsedges), *Asclepias* spp. (milkweeds), *Aristida lanosa* and *A. desmantha* (three-awn grasses), *Smilax pumila* (sarsaparilla vine), *Cnidoscolous texana* (bull-nettles), *Tephrosia virginiana* (goat's-rue), and *Tradescantia reverchonii* (downy spider wort). Foliose lichens (especially those in the genera *Cladina* and *Cladonia*) may occur in profusion. Many state-rare species are indigenous to this habitat, including *Astragalus soxmaniorum* (soxman's milk-vetch), *Zornia bracteata* (viperina), *Streptanthus hyacinthoides* (smooth twistflower), *Polanisia erosa* (large clammy-weed), *Penstemon murrayanus* (cupleaf beardtounge), *Eriogonum longifolium* and *E. multiflora* (wild buckwheats), *Silene subcilliata* (scarlet catchfly), *Tetragonotheca ludoviciana* (Louisiana square-head), *Prunus gracilis* (sandhill plum), and others.

Current Extent and Status:



Presettlement extent of Western Xeric Sandhill Woodland habitat is estimated to have been 50,000 to 100,000 acres, with 10 to 25 % remaining today (Smith 1993). Northern Caddo Parish is a "hotspot" for this habitat with a relatively high concentration of sandhill woodlands. However, most of the sandhill woodlands there are highly degraded (MacRoberts and MacRoberts 1995). There are opportunities for restortation of this habitat in Caddo Parish.

There are several protected examples of sandhill woodlands on KNF in Natchitoches Parish, including one that is registered with the Louisiana Natural Areas Registry Program (Saline Bayou Sandylands Natural Areas, 64 acres). There is a well-known stream terrace sandhill woodland site near Goldonna in Winn Parish on an in-holding within KNF. The site has been known as a unique botanical area since the 1930s. The condition of the interior of the woodland needs to be determined.

There is a high concentration of stream terrace sandy woodlands mainly along the Calcasieu River and its tributaries in southwest Louisiana, as well as along the Sabine River. The principle soil series supporting these woodlands is Bienville loamy fine sand. Recent inspection of aerial photographs revealed that many of these stream terrace sandy woodlands, particularly the largest and highest in elevation, have been converted to densly-stocked pine plantations. At present there are only fragments of this habitat known in southwest Louisiana. Locating and protecting remaining examples of this habitat should be a conservation priority.

WESTERN XERIC SANDHILL WOODLANDS SPECIES OF CONSERVATION CONCERN (15)		
AMPHIBIANS	Loggerhead Shrike	**MAMMALS**
Strecker's Chorus Frog	Prairie Warbler	Ringtail
	Field Sparrow	
BIRDS		**REPTILES**
Northern Bobwhite	**BUTTERFLIES**	Western Slender Glass Lizard
American Woodcock	Wild Indigo Duskywing	Southern Prairie Skink
Yellow-billed Cuckoo	Cobweb Skipper	Northern Scarlet Snake
Chuck-Will's-Widow		Louisiana Pine Snake

Priority Species Research and Survey Needs:

Chuck-Will's-Widow: Research is needed to better understand the population dynamics of this species. Studies should focus on distribution patterns, habitat availability and use, nesting success, and territory size requirements. Implementation of night-time surveys along with sighting reports by foresters, birders, etc. are needed to augment sparse BBS records.

Loggerhead Shrike: BBS data for the period 1966-2000 indicate a 71% population decline range-wide. Monitoring of reproductive success and the effects of pesticides in reducing food availability are needed along with statewide evaluation of changes in available habitat.

Butterflies: Conduct surveys to determine the current distribution and abundance of all butterfly species, especially species of conservation concern, for inclusion in the LNHP database.

Ringtail: Louisiana represents the eastern edge of its range. Intensive surveys are needed to determine its current status in Louisiana.

Western Slender Glass Lizard: Occurrence in Western Xeric Sandhill Woodlands likely but imperfectly known. Glass lizards are declining over much of their range, regardless of habitat alteration. Determine the extent of any correlations between glass lizard occurrence and Western Xeric Sandhill Woodlands.

Louisiana Pine Snake: A sandhill specialist with a severely reduced range. Sandhills are also necessary for its principle prey – Baird's Pocket Gopher (*Geomys breviceps*). The quality of remaining habitat has been degraded due to logging, fire suppression, short-rotation silviculture, and conversion to pasture lands. Some of the best remaining populations occur on industrial forest lands. Continue to support research into this species life history, limiting factors that reduce reproductive success, and the use of herbicides instead of prescribed burning on composition and/or density of ground cover vegetation and its effects on pocket gophers.

Species Conservation Strategies:

1. Chuck-Will's-Widow: Work with federal agencies and bird conservation organizations to produce technical pamphlets highlighting the habitat and management requirements of this species and make them available to landowners.
2. Louisiana Pine Snake:
   - Maintain open canopy pine woodland in xeric sandhill community.
   - Eliminate root chopping at sites under timber management.
   - Continue to work with timber industry, USFS, and USFWS to promote habitat and species conservation strategies to increase populations on quality sites.
   - Implement conservation and management recommendations of SWG project T10 upon completion.

Threats Affecting Habitat:

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat: Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Commercial/industrial development		XXX		XXX
Conversion to agriculture or other forest types		XXX		XXX
Development/maintenance of pipelines, roads or utilities		XXX		XXX
Fire suppression	XXX			
Incompatible forestry practices	XXX		XXX	
Oil or gas drilling		XXX		XXX
Parasites/pathogens	XXX			
Recreational use/vehicles			XXX	
Residential development		XXX	XXX	XXX

Habitat Conservation Strategies:

1. Conduct surveys to determine the current extent and condition of this habitat type.
2. Develop management plans/recommendations for this habitat type.
3. Develop relationships with mineral rights owners and work to minimize impacts from mineral extraction activities.
4. Provide education/outreach to promote conservation and preservation of this habitat type.
5. Identify priority areas for land acquisition or preservation/conservation.
6. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots in this habitat type.
7. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
8. Support research to understand the basic ecosystem characteristics and processes of this habitat type.
9. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamplets and the LDWF website.

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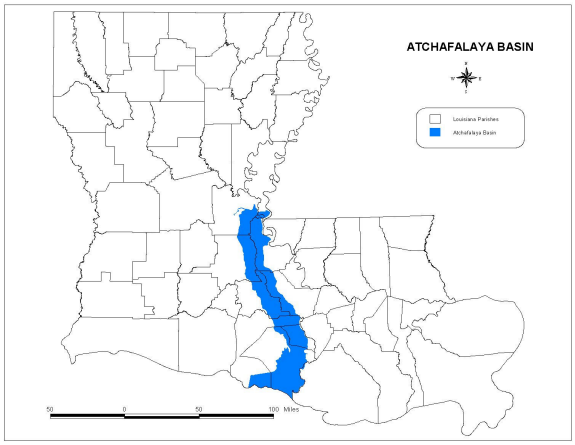
B. Aquatic Habitats

1. Freshwater Habitats

a. Atchafalaya Basin

General Description:

The Atchafalaya Basin, at nearly 1 million acres, is the nation's largest river-swamp system (Demas et al. 2001). Located in south-central Louisiana, the system stretches from the river's origin near Simmesport to its termination into the Atchafalaya Bay. It is contained on its east and west borders by flood protection levees. Water flow into the Atchafalaya Basin is controlled at the Old River control structure. The structure diverts 30% of Mississippi River water down through the Atchafalaya Basin (LDEQ 1993). A unique feature of the Atchafalaya Basin system is that is has one of the last active river deltas in the state (LCWCRTF 1993).



The Atchafalaya Basin has many commercial uses including commercial fishing, trapping, logging, oil and gas production, nature tours, and limited commerce. Recreational activities include fishing, hunting, camping, bird watching, swimming, and boating. Species diversity of the Atchafalaya Basin ecosystem ranges from wild turkeys in the bottomland hardwood forests of Pointe Coupee parish to blue crabs and shrimp in the coastal marshes.

There are roughly 100 species of freshwater fishes (W. Kelso, personal communication), 22 species of mussels (Vidrine 1993), and 10 species of crawfish (J. Walls, personal communication) found within the Atchafalaya Basin.

Water Quality:

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 50% of the 12 water body subsegments within the basin were fully supporting their three primary designated uses. However, 50% of the subsegments were not supporting their designated

use for fish and wildlife propagation. The suspected causes for these water quality problems include: fecal coliform, suspended solids, sedimentation/siltation, mercury, turbidity, and low concentration of dissolved oxygen. The suspected sources of the water quality problems include: crop production, petroleum activities, channelization, dredging, industrial point sources, waste storage/tank leaks, and spills.

ATCHAFALAYA BASIN SPECIES OF CONSERVATION CONCERN (9)	
FRESHWATER FISH	**REPTILES**
Pallid Sturgeon	Alligator Snapping Turtle
Paddlefish	Ouachita Map Turtle
Bluehead Shiner	Mississippi Diamond-backed Terrapin
Blue Sucker	
Gulf Pipefish	
Western Sand Darter	

Priority Species Research and Survey Needs:

Blue Sucker: Additional surveys are needed, specifically targeting its preferred habitat, as recommended in WCRP project R1 (Bart and Rios 2003).

Fish: Taxonomic inventory of all fish species throughout the entire river basin are needed to determine their current population distributions and abundance.

Alligator Snapping Turtle: Baseline mark-release data were obtained during the late 1990s. New surveys are needed to obtain population trend data for this species.

Species Conservation Strategies:

1. Develop "white paper" on issues associated with Old River control structure as it affects on pallid sturgeon and address these issues with the COE.

Threats Affecting Basin:

The following table illustrates the threats identified for the Atchafalaya Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

Source of Threat	Threat: Altered Composition/ Structure	Altered Water Quality	Competition for Resources	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of water levels; changes in natural flow patterns	Nutrient Loading	Sedimentation
Channelization of rivers or streams	XXX	XXX		XXX	XXX	XXX	XXX	XXX	XXX
Construction of navigable waterways	XXX	XXX		XXX	XXX	XXX	XXX	XXX	XXX
Dam construction	XXX			XXX			XXX		
Invasive/alien species	XXX		XXX	XXX			XXX		
Levee or dike construction	XXX	XXX		XXX		XXX	XXX	XXX	XXX
Oil or gas drilling					XXX		XXX		
Operation of dams or reservoirs	XXX			XXX			XXX	XXX	XXX
Shoreline stabilization	XXX			XXX			XXX	XXX	XXX

Basin Conservation Strategies:

1. Promote oil spill prevention (Spill Prevention Control, SPC) regulations and natural resource response mechanisms (Natural Resource Damage Assessments, NRDA).
2. Promote the use of BMP's for water runoff. Promote enforcement of sanitary regulations.
3. Promote methods to restore historical flow regimes within the Atchafalaya Basin.
4. Monitor nutrient inputs/water quality (utilize existing data, USGS stations).
5. Support research efforts.
6. Prepare educational material on potential impacts of invasive species in the Atchafalaya Basin.
7. Coordinate with Atchafalaya Basin Program (LDNR) and BTNEP to abate a multitude of threats to this basin.

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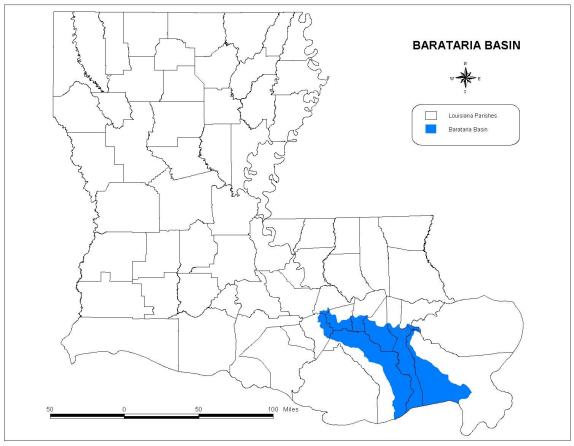
b. Barataria Basin

General Description:



The upper Barataria Basin was formed approximately 3,500-4,000 years ago as part of the Lafourche Delta complex. Encompassing approximately 300,000 acres, it is bordered on the north and east by the levees of the Mississippi River, which were constructed after the flood of 1927, on the west by Bayou Lafourche and on the south by the Gulf of Mexico. The basin is mainly comprised of the following 4 terrestrial habitat types: ag-crop-grasslands (primarily sugarcane), bottomland hardwood forests, cypress-tupelo swamps, and coastal marshes which range from fresh to salt water. Almost all freshwater input is from local precipitation with minor inflow from the Greater Intracoastal Waterway (LaCoast 2005). Wetland loss due to coastal erosion is a major environmental issue affecting the basin.

There are roughly 55 species of freshwater fishes (W. Kelso, personal communication) and 9 species of crawfish (J. Walls, personal communication) found within the Barataria Basin. The basin supports many commercial activities ranging from sugarcane production and aquaculture to commercial fishing, trapping, logging, and oil and gas production. Recreational activities include fishing, hunting, bird watching, swimming, and boating.

Water Quality:

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 35% of the 26 water body subsegments within the basin were fully supporting their three primary designated uses. However, 65% of the subsegments were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, nutrients, oil and grease, fecal coliform, low concentration of dissolved oxygen, dissolved and suspended solids, and turbidity. The suspected sources of the water quality problems include: crop production, pastureland, urban runoff, septic tanks, spills, minor industrial point sources, petroleum activities, highway and maintenance runoff, hydromodification, and dredging.

BARATARIA BASIN SPECIES OF CONSERVATION CONCERN (4)	
FRESHWATER FISH	**REPTILES**
Paddlefish	Alligator Snapping Turtle
Gulf Pipefish	Mississippi Diamond-backed Terrapin

Priority Species Research and Survey Needs:

Fish: Taxonomic inventory of all fish species throughout the entire river basin are needed to determine their current population distributions and abundance.

Mississippi Diamondback Terrapin: The status of this species is unknown. Endangered Species Act candidate status is pending. Evaluate trawl data from LDWF Marine Fisheries trawl surveys for distribution estimates. Initiate surveys in vicinity of recent trawl captures to assess current population abundance.

Species Conservation Strategies:

1. Mississippi Diamondback Terrapin: Conservation of coastal dune habitat is paramount to terrapin reproduction. Continued removal of abandoned crab traps will drastically reduce incidental mortality.
2. Initiate long-term sampling to identify trends in the distribution and abundance of native and invasive species within the Barataria Basin.
3. Work with LCA, CWPPRA to incorporate strategies developed for aquatic species of conservation concern into future coastal restoration efforts.

Threats Affecting Basin:

The following table illustrates the threats identified for the Barataria Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

	Threat						
Source of Threat	Altered Composition/ Structure	Altered Water Quality	Habitat Disturbance	Modification of Water Levels; Changes in Natural Flow Patterns	Nutrient Loading	Salinity Alteration	Sedimentation
Channelization of rivers or streams	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Commercial/industrial development	XXX	XXX	XXX			XXX	XXX
Construction of ditches, drainage or diversion systems	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Construction of navigable waterways	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Incompatible forestry practices	XXX	XXX	XXX		XXX		XXX
Invasive/alien species	XXX	XXX	XXX				
Levee or dike construction	XXX	XXX	XXX	XXX			
Mining practices	XXX	XXX	XXX	XXX	XXX		XXX
Oil or gas drilling	XXX	XXX	XXX	XXX	XXX	XXX	XXX

Basin Conservation Strategies:

1. Support efforts to construct fresh water diversion canals from the Mississippi River into the Barataria Basin.
2. Work with BTNEP to coordinate efforts to abate threats to this basin.

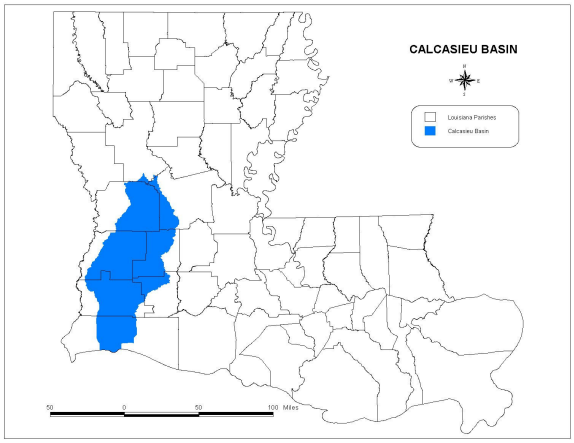
References:

LACOAST. 2005. Louisiana Coastal Restoration and Conservation Task Force Website. Barataria Basin: Summary of Basin Plan. http://www.lacoast.gov/geography/ba/barsum.htm.

LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY. 2004. Louisiana Water Quality Inventory: Integrated Report. Water Quality Assessment Division, Standards Assessment and Nonpoint Source Section. Baton Rouge, LA. 110 pp.

c. Calcasieu Basin

General Description:



The Calcasieu River Basin, located in southwest Louisiana, comprises approximately 4,105 square miles of drainage area and represents 8 percent of the area of the state. Headwaters of the river are found in the hills west of the city of Alexandria. Flow is in a southerly direction for about 215 miles to the Gulf of Mexico where it empties at a point 30 miles east of the Louisiana-Texas state line. From the upland hills with elevations generally being around 260 feet above mean sea level (a maximum of 400 feet above mean sea level) the river flows through the coastal prairie and coastal marshes, which have an elevation ranging from 1-2 feet above mean sea level. The flood plains are extremely flat with little relief and average 2-3 feet above mean sea level. The river flows through the following lakes: Lake Charles, Prien Lake, Moss Lake and Calcasieu Lake. Dominant features include oxbow lakes, natural levees and the surrounding Pleistocene Uplands (Weston 1974). The city of Lake Charles lies in the southern portion of the basin and this area has been heavily industrialized by petro-chemical plants.

The Calcasieu river varies from a small fast flowing stream in the headwaters to a broad, sluggish estuary from the latitude of Lake Charles to its entrance into the gulf. Flows in the upper basin may range from a high of 180,000 cubic feet per second in the winter and spring to zero during the summer and fall. The lower portion of the river from the city of Lake Charles to the gulf is subject to tidal variation. A semidiurnal tide extends 65 miles upstream and has mean tidal ranges of 1.7 feet at the river mouth and 0.7 foot at Lake Charles. An existing saltwater barrier across the Calcasieu River at Lake Charles divides the upper and lower basins and prevents saltwater intrusion from degrading this major source of irrigation water supply for rice production. Navigation improvements have modified the Calcasieu from its mouth approximately 52.6 river miles inland (Weston 1974).

There are roughly 75 species of freshwater fishes (W. Kelso, personal communication), 30 species of mussels (Vidrine 1993), and 16 species of crawfish (J. Walls, personal communication) found within the Calcasieu Basin.

Water Quality:

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 23% of the 39 water body subsegments within the basin were fully supporting their three primary designated uses. However, 71% of the subsegments were not supporting their designated

use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, nutrients, fecal coliform, organic enrichment and low concentration of dissolved oxygen, dissolved and suspended solids, and turbidity. The suspected sources of the water quality problems include: home sewage systems, agriculture, silviculture, urban storm water runoff, and dredging.

CALCASIEU BASIN SPECIES OF CONSERVATION CONCERN (11)		
CRUSTACEANS	Western Sand Darter	**REPTILES**
Calcasieu Painted Crawfish	Bigscale Logperch	Alligator Snapping Turtle
Teche Painted Crawfish		Mississippi Diamond-backed Terrapin
Old Prairie Crawfish	**MUSSELS**	
	Sandbank Pocketbook	
FRESHWATER FISH	Louisiana Pigtoe	
Paddlefish	Southern Creekmussel	

Priority Species Research and Survey Needs:

Fish: Taxonomic inventory of all fish species throughout the entire river basin are needed to determine their current population distributions and abundance.


Calcasieu painted crawfish

Mussels: Surveys are needed to update historic occurrence records and develop new baseline data on current species population distributions and abundance.

Crustaceans: Continued surveys of historic locality records are needed to update species abundance and distribution data for inclusion in the LNHP database.

Mississippi Diamondback Terrapin: The status of this species is unknown. Endangered Species Act candidate status is pending. Evaluate trawl data from LDWF Marine Fisheries trawl surveys for distribution estimates. Initiate surveys in vicinity of recent trawl captures to assess current population abundance.

Species Conservation Strategies:

1. Identify sites where low head dams are present and evaluate their effects on fish distribution/dispersal patterns. Develop recommendations to improve fish passage through low head dams.
2. Sampling is needed to identify trends in the range and abundance of invasive fish species (especially carp). Incorporate recommendations of State Management Plan for Aquatic Invasive Species (LDWF 2005) to control invasive fish species.

Threats Affecting Basin:

The following table illustrates the threats identified for the Calcasieu Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

	Threat							
Source of Threat	Altered Composition/ Structure	Altered Water Quality	Habitat Destruction or Conversion	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns	Salinity Alteration	Sedimentation	Toxins/ Contaminants
Channelization of rivers or streams	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Commercial/industrial development	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Construction of ditches, drainage or diversion systems	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Construction of navigable waterways	XXX	XXX		XXX	XXX	XXX	XXX	XXX
Conversion to agriculture or other forest types							XXX	
Development/maintenance of pipelines, roads or utilities	XXX	XXX		XXX	XXX	XXX	XXX	XXX
Industrial discharge	XXX	XXX		XXX	XXX	XXX	XXX	XXX
Operation of drainage or diversion systems	XXX	XXX		XXX	XXX	XXX	XXX	XXX
Residential development	XXX	XXX		XXX	XXX	XXX	XXX	XXX

Basin Conservation Strategies:

1. Support current initiatives and develop new programs where necessary that help reduce siltation and sedimentation throughout the Calcasieu Basin.
2. Work with the Louisiana Aquatic Nuisance Species Task Force (LANSTF) to identify and address threats related to invasive species.
3. Develop partnerships with regulatory agencies to share data on habitat threats and to ensure compliance of existing regulations.
4. Develop an internal procedure to distribute information on proposed reservoirs to LDWF fisheries biologists to solicit their input into LDWF comments on these proposed documents.

References:

LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY. 2004. Louisiana Water Quality Inventory: Integrated Report. Water Quality Assessment Division, Standards Assessment and Nonpoint Source Section. Baton Rouge, LA. 110 pp.

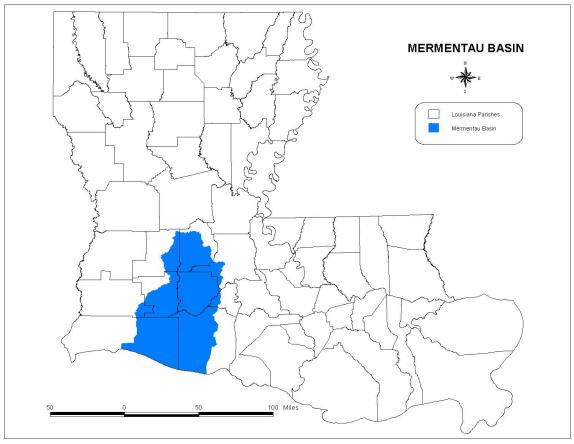
LOUISIANA DEPARTMENT OF WILDLIFE AND FISHERIES. 2004b. State Management Plan for Aquatic Invasive Species in Louisiana. Draft. Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

VIDRINE, M. F. 1993. The historical distribution of freshwater mussels in Louisiana. Gail Q. Vidrine Collectables. Eunice, LA. 225 pp.

WESTON, R. F. INC. 1974. Water Quality Management Plan for the Calcasieu River Basin. Prepared for Louisiana Health and Social and Rehabilitation Services Administration.

d. Mermentau Basin

General Description:



The Mermentau River Basin is located in the southwestern part of Louisiana and comprises a drainage area of approximately 6,730 square miles. This basin, located between the Teche-Vermilion and Calcasieu river basins, comprises a controlled system for the drainage of Mermentau River and its tributaries. Catfish Point and Schooner Bayou Control Structures and Calcasieu and Leland Bowman Locks control the impoundment of winter runoff for irrigation use in the summertime (COE 1998).

The basin is composed of 3 different and distinctive land forms which are arranged in broad bands from north to south. The northern part of the basin is a flatwoods area which gives way to an undulating landscape extending northward into the drainage basins of the Calcasieu and Red Rivers. To the south of the flatwoods area lies a broad prairie which extends from Bayou Teche on the east to a point near Vinton, Louisiana (located in the Calcasieu Basin) to the west. The prairie is characterized by large expanses of flat grassland dissected by the numerous tributaries of the basin and dotted with "islands" of oak trees and other mixed hardwoods. The prairie, which is extensively cultivated, gives way to a band of marshland which extends from east to west along Louisiana's entire coastline. The marsh is further subdivided into a fresh water marsh, which borders the prairie to the north, then merges into intermediate and brackish marshes and finally terminating with salt water marsh which forms the coastline adjacent to the Gulf of Mexico and its bays (Domingue, Szabo & Assoc. Inc. 1975).

The lower portion of the basin is bounded on the east by Freshwater Bayou Channel, on the south by the Gulf of Mexico, on the west by Louisiana Highway 27, and on the north by the Gulf Intercoastal Waterway (GIWW). This portion of the basin contains about 450,000 acres of wetlands, consisting of 190,000 acres of fresh marsh, 135,000 acres of intermediate marsh, and 101,000 acres of brackish marsh. A total of 104,380 acres of marsh has converted to open water since 1932, a loss of 19% of the historical wetlands in the basin and represents 9% of wetland loss in Louisiana (LaCoast 2005).

There are roughly 64 species of freshwater fishes (W. Kelso, personal communication), 22 species of mussels (Vidrine 1993), and 13 species of crawfish (J. Walls, personal communication) found within the Mermentau Basin.

Water Quality:

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 5% of the 20 water body subsegments within the basin were fully supporting their three primary designated uses. However, of the 20 subsegments, only the Mermentau River from the Catfish Point control structure to the Gulf of Mexico (Estuarine) was fully supporting its designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, nutrients, fecal coliform, organic enrichment and low concentration of dissolved oxygen, pesticides, dissolved and suspended solids, and turbidity. The suspected sources of the water quality problems include: home sewage systems, agriculture, silviculture, urban storm water runoff, and dredging.

MERMENTAU BASIN SPECIES OF CONSERVATION CONCERN (5)		
CRUSTACEANS	**FRESHWATER FISH**	**REPTILES**
Teche Painted Crawfish	Paddlefish	Alligator Snapping Turtle
Old Prairie Crawfish		Mississippi Diamond-backed Terrapin

Priority Species Research and Survey Needs:

Paddlefish: Continue with stock assessment surveys.


paddlefish

Crustaceans: Continue surveys to update historic locality records in order to update abundance and distribution data for inclusion in the LNHP database.

Mississippi Diamondback Terrapin: The status of this species is unknown. Endangered Species Act candidate status is pending. Evaluate trawl data from LDWF Marine Fisheries trawl surveys for distribution estimates. Initiate surveys in vicinity of recent trawl captures to assess current population abundance.

Species Conservation Strategies:

1. Sampling is needed to identify trends in the range and abundance of invasive fish species (especially carp). Incorporate recommendations of State Management Plan for Aquatic Invasive Species (LDWF 2004b) to control invasive fish species.
2. Crustaceans:
   - Develop strategies to abate further degradation of streams known to contain populations of crawfish species of conservation concern derived from SWG project T10 (Walls 2003).
   - Continue to monitor known populations through periodic surveys to maintain current database records.

Threats Affecting Basin:

The following table illustrates the threats identified for the Mermentau Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

	Threat							
Source of Threat	Altered Composition/ Structure	Altered Water Quality	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns	Nutrient Loading	Salinity Alteration	Sedimentation	Toxins/ Contaminants
Channelization of rivers or streams	XXX	XXX	XXX	XXX		XXX	XXX	
Commercial/industrial development	XXX		XXX				XXX	XXX
Construction of ditches, drainage or diversion systems	XXX		XXX	XXX		XXX		
Conversion to agriculture or other forest types		XXX		XXX	XXX		XXX	
Crop production practices	XXX	XXX		XXX	XXX		XXX	XXX
Development/maintenance of pipelines, roads or utilities	XXX	XXX	XXX	XXX	XXX		XXX	
Incompatible forestry practices		XXX					XXX	XXX
Industrial discharge		XXX						XXX
Livestock production practices	XXX	XXX		XXX			XXX	XXX
Operation of drainage or diversion systems	XXX	XXX		XXX	XXX	XXX	XXX	
Residential development	XXX	XXX	XXX	XXX			XXX	XXX

Basin Conservation Strategies:

1. Work with LANSTF to identify and address threats related to invasive species.
2. Develop partnerships with regulatory agencies to share data on habitat threats and to ensure compliance of existing regulations.
3. Partner with federal and state agencies to address water quality issues in the Mermentau Basin (USGS, NRCS, LDEQ, LFA, LSU Ag Extension).
4. Support current initiatives and develop new programs where necessary that help reduce siltation and sedimentation throughout the Mermentau Basin.

References:

DOMINGUE, SZABO, AND ASSOCIATES. INC. 1975. Water Quality Management Plan, Mermentau-Vermilion-Teche Basin. Prepared for Louisiana Health and Human Resources Administration.

LACOAST. 2005. Louisiana Coastal Restoration and Conservation Task Force Website. Mermentau Basin: Summary of Basin Plan. http://www.lacoast.gov/geography/me/index.asp.

LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY. 2004. Louisiana Water Quality Inventory: Integrated Report. Water Quality Assessment Division, Standards Assessment and Nonpoint Source Section. Baton Rouge, LA. 110 pp.

LOUISIANA DEPARTMENT OF WILDLIFE AND FISHERIES. 2004b. State Management Plan for Aquatic Invasive Species in Louisiana. Draft. Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

U.S. ARMY CORPS OF ENGINEERS. 1998. Water resources development in Louisiana. U.S. Army Corps of Engineers, New Orleans District. 191 pp.

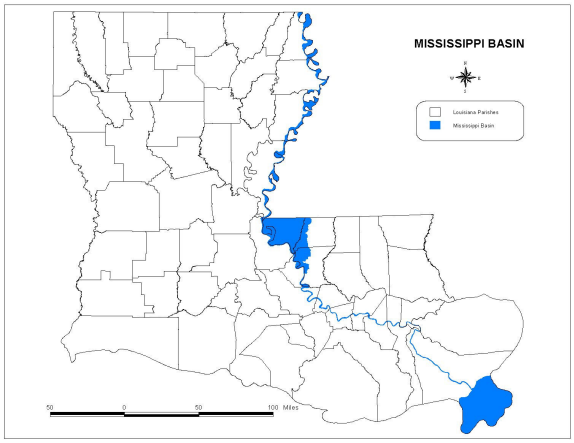
VIDRINE, M. F. 1993. The historical distribution of freshwater mussels in Louisiana. Gail Q. Vidrine Collectables. Eunice, LA. 225 pp.

WALLS, J. G. 2003. Survey of localities fourteen threatened crawfish species in Louisiana. Final report to the Louisiana Natural Heritage Program. Louisiana Department of Wildlife and Fisheries. Baton Rouge, LA.

e. Mississippi Basin

General Description:

The portion of the Mississippi River which occurs in Louisiana is part of the Lower Missisippi Drainage Basin which extends from from Cairo, Illinois to Head-of-Passes in the Gulf of Mexico. Within Louisiana, the Mississippi Basin is comprised of the Mississippi river along with West Feliciana Parish, portions of East Feliciana Parish east of Redwood Creek, portions of East Baton Rouge Parish east of the Comite River and the city of Baton Rouge, and the delta. The river is completely leveed on its western side from the Arkansas line to Venice and on its eastern side from Baton Rouge to Venice.



The primary habitat types within the basin are batture lands, bottomland hardwood forests, and sandbars. The basin also contains all of the southern mesophytic forest found in Louisiana. The delta is characterized by river channels with attendant channel banks, natural bayous, and man-made canals which are interspersed with intermediate and fresh marshes.

The Mississippi River contains at least 260 different species of fish which comprises 25% of all fish species in North America (NPS 2004). There are roughly 54 species of freshwater fishes (W. Kelso, personal communication), 3 species of mussels (Vidrine 1993), and 13 species of crawfish (J. Walls, personal communication) found within the Mississippi Basin in Louisiana.

Water Quality:

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that, of the 17 water body subsegments within the basin, the 3 water body subsegments comprising the Mississippi River from the Arkansas state line to the Head-of-Passes were fully supporting their three primary designated uses, 6 subsegments were partially meeting or not meeting their designated uses, and 8 had insufficient or no data. Of the 10 subsegments for which data was collected, 40% were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, nutrients, polychlorinated biphenyls (PCBs), hexachlorobenzene, fecal

coliform, organic enrichment and low concentration of dissolved oxygen, oil and grease, non-native aquatic plants, and turbidity. The suspected sources of the water quality problems include: home sewage systems, agriculture, silviculture, urban storm water runoff, and dredging.

MISSISSIPPI BASIN SPECIES OF CONSERVATION CONCERN (14)		
CRUSTACEANS	Chub Shiner	**MUSSELS**
Vernal Crawfish	Bluntface Shiner	Fat Pocketbook
	Blue Sucker	
FRESHWATER FISH	Gulf Pipefish	**REPTILES**
Pallid Sturgeon	Rainbow Darter	Alligator Snapping Turtle
Paddlefish	Bigscale Logperch	Ouachita Map Turtle
Central Stoneroller		Mississippi Diamond-backed Terrapin

Priority Species Research and Survey Needs:

Pallid Sturgeon: Conduct research to assess current population abundance and genetic integrity of this species in the lower Mississippi River as recommended in WCRP project R1 (Bart and Rios 2003).

Blue Sucker: Additional surveys are needed, specifically targeting its preferred habitat as recommended in WCRP project R1 (Bart and Rios 2003).

Fat Pocketbook and Vernal Crawfish: Intensive surveys are needed to update current population distribution and abundance of these species in the LNHP database. Research is needed to evaluate current habitat threats and develop management strategies to abate these threats.

Alligator Snapping Turtle: Baseline mark-release data were obtained during the late 1990s. New surveys are needed to obtain population trend data for this species.

Species Conservation Strategies:

1. Turtles: Monitor the effects of the pet trade on population densities and determine the effects of human disturbance on nesting areas. Incorporate current management guidelines (i.e., PARC) and develop new guidelines to address data gaps.
2. Work with landowners to initiate or continue the implementation of conservation plans developed for amphibians and reptiles along with USFWS threatened and endangered species recovery plans over the next 10 years.

Threats Affecting Basin:

The following table illustrates the threats identified for the Mississippi Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

Source of Threat	Threat: Altered Composition/ Structure	Altered Water Quality	Habitat Disturbance	Modification of Water Levels; Changes in Natural Flow Patterns	Nutrient Loading	Sedimentation	Toxins/ Contaminants
Channelization of rivers or streams	XXX	XXX	XXX	XXX		XXX	
Commercial/industrial development		XXX					XXX
Construction of ditches, drainage or diversion systems	XXX	XXX	XXX	XXX		XXX	
Construction of navigable waterways	XXX	XXX	XXX	XXX		XXX	
Crop production practices		XXX			XXX		XXX
Industrial discharge		XXX					XXX
Invasive/alien species	XXX		XXX				
Livestock production practices		XXX			XXX		
Mining practices	XXX	XXX	XXX			XXX	XXX
Oil or gas drilling	XXX	XXX	XXX			XXX	XXX
Shoreline stabilization	XXX	XXX	XXX	XXX		XXX	

Basin Conservation Strategies:

1. Develop a comprehensive survey methodology for the Mississippi River and its tributaries.
2. Develop partnerships with regulatory agencies to share data on habitat threats and to ensure compliance of existing regulations.
3. Work with LANSTF to identify and address threats related to invasive species.
4. Prepare educational material on importance of access to the Mississippi River.
5. Work with local agencies and the public to develop access to the river.
6. Continue LDWF involvement in the environmental review process of all river related projects. Identify potential impacts and recommend appropriate mitigation.
7. Work with Lower Mississippi River Conservation Committee (LMRCC) on important river issues.

References:

BART, H. L., AND N. E. RIOS. 2003. Status of rare and protected Inland Fishes of Louisiana. Final report submitted to Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries.

LACOAST. 2005. Louisiana Coastal Restoration and Conservation Task Force Website. Mississippi River Delta Basin. http://www.lacoast.gov/geography/mr/index.asp.

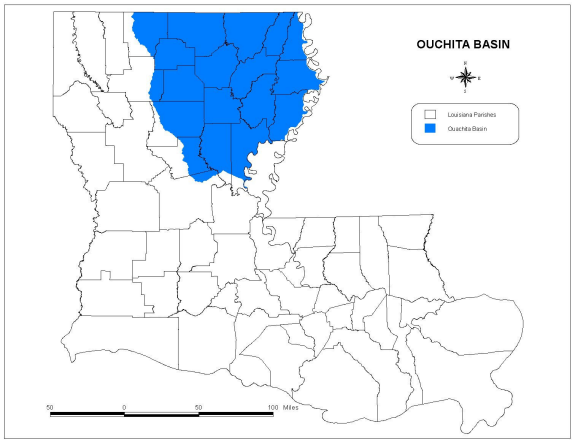
LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY. 2004. Louisiana Water Quality Inventory: Integrated Report. Water Quality Assessment Division, Standards Assessment and Nonpoint Source Section. Baton Rouge, LA. 110 pp.

NATIONAL PARK SERVICE. 2004. General Information about the Mississippi River. Website. http://www.nps.gov/miss/features/factoids.

VIDRINE, M. F. 1993. The historical distribution of freshwater mussels in Louisiana. Gail Q. Vidrine Collectables. Eunice, LA. 225 pp.

f. Ouachita Basin

General Description:



The Ouachita River system is the principal drainage for south Arkansas and northeast Louisiana, draining an approximate area of 26,000 square miles. The source of the river is found in the Ouachita Mountains of west-central Arkansas near the Oklahoma border. The river flows south through northeast Louisiana and joins with the Tensas River north of the town of Jonesville to form the Black River, which empties into the Red River. The total length of the river is 542 miles. In Louisiana, the Ouachita Basin covers 10,000 square miles of drainage area (LDEQ 1993) which mostly consists of rich alluvial plains cultivated in soybeans, cotton, and corn. The northwest corner of the basin is forested in pine, much of which is commercially harvested. Bayou Bartholomew and Bayou D'Arbonne are the major tributaries of the Ouachita.

There are two lock and dams on the Ouachita in Louisiana. The Jonesville and Columbia lock and dams were constructed by the COE and opened to navigation in 1972. Each structure impounds a slack-water pool approximately 100 miles long. Benefits to fish and wildlife of the Ouachita-Black navigation project in Louisiana include the Catahoula Diversion Channel and Control Structure and the Little River Closure Dam. The diversion channel and structure and closure dams are located in the Jonesville Lock and Dam pool southwest of Jonesville. The diversion channel diverts flows from Catahoula Lake into Black River, downstream from the lock and dam. The control structure is used to regulate the flow entering the diversion channel from the lake. The closure dam is located on Little River. These features allow for regulation of stages in the lake to permit its continued use as a resting and feeding area for migratory waterfowl (COE 1998).

There are roughly 118 species of freshwater fishes (W. Kelso, personal communication), 49 species of mussels (Vidrine 1993), and 19 species of crawfish (J. Walls, personal communication) found within the Ouachita Basin.

Water Quality:

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 22% of the 61 water body subsegments within the basin were fully supporting their three primary designated uses. However, 76% of the subsegments were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, pesticides, nutrients, fecal coliform, organic enrichment and

low concentration of dissolved oxygen, oil and grease, non-native aquatic plants, sedimentation/siltation, and turbidity. The suspected sources of the water quality problems include: home sewage systems, agriculture, silviculture, urban storm water runoff, surface mining, and dredging.

OUACHITA BASIN SPECIES OF CONSERVATION CONCERN (24)			
CRUSTACEANS	Bluehead Shiner	Pink Mucket	Rabbitsfoot
Vernal Crawfish		Fatmucket	Monkeyface
Elegant Crawfish	**MUSSELS**	White Heelsplitter	Squawfoot
	Mucket	Black Sandshell	
FRESHWATER FISH	Western Fanshell	Hickorynut	**REPTILES**
Paddlefish	Butterfly	Pyramid Pigtoe	Alligator Snapping Turtle
Bigeye Shiner	Spike	Fat Pocketbook	Ouachita Map Turtle
Steelcolor Shiner	Ebonyshell	Ouachita Kidneyshell	

Priority Species Research and Survey Needs:


Alligator Snapping Turtle

Crustaceans: Continue surveys to update historic locality records in order to update abundance and distribution data for inclusion in the LNHP database.

Mussels: Surveys are needed to update historic occurrence records and develop new baseline data on current species population distributions and abundance.

Alligator Snapping Turtle: Baseline mark-release data were obtained during the late 1990s. New surveys are needed to obtain population trend data for this species.

Species Conservation Strategies:

1. Develop a comprehensive survey methodology to determine long term trends in freshwater fish population abundances of the entire Ouachita Basin.
2. Mussels: Implement conservation and management strategies from SWG project T10 upon completion.

Threats Affecting Basin:

The following table illustrates the threats identified for the Ouachita Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

Source of Threat	Threat: Altered Composition/ Structure	Altered Water Quality	Competition for Resources	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns	Nutrient Loading	Sedimentation	Toxins/ Contaminants
Channelization of rivers or streams				XXX	XXX	XXX			XXX	
Construction of ditches, drainage or diversion systems				XXX	XXX	XXX	XXX		XXX	
Construction of navigable waterways				XXX	XXX		XXX		XXX	
Conversion to agriculture or other forest types				XXX			XXX	XXX	XXX	
Crop production practices		XXX	XXX	XXX	XXX		XXX	XXX		XXX
Dam construction	XXX			XXX	XXX		XXX		XXX	
Development/maintenance of pipelines, roads or utilities				XXX	XXX	XXX	XXX		XXX	
Incompatible forestry practices				XXX	XXX				XXX	XXX
Industrial discharge		XXX								XXX
Invasive/alien species			XXX							
Levee or dike construction				XXX	XXX		XXX		XXX	
Livestock production practices		XXX			XXX			XXX	XXX	
Oil or gas drilling					XXX	XXX				
Operation of dams or reservoirs					XXX		XXX		XXX	
Operation of drainage or diversion systems					XXX		XXX		XXX	
Mining practices				XXX	XXX				XXX	XXX
Residential development		XXX		XXX	XXX	XXX		XXX		
Wetland fill					XXX				XXX	

Basin Conservation Strategies:

1. Improve partnerships with LDEQ, NRCS, TNC, LSU CoOp Extension Service and others to share data on threats to this watershed and participate in the development of future strategies to abate these identified threats.
2. Work with LANSTF to identify and address threats related to invasive species.
3. Prepare educational material on potential impacts of invasive species to the Ouachita River and its tributaries.
4. Continue LDWF involvement in the environmental review process of all river related projects. Identify potential impacts and recommend appropriate mitigation.
5. Develop education and outreach programs with NRCS to reduce sediments and nutrient loading within the Ouachita Basin.
6. Work with LMRCC on important river issues.

References:

LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY. 1993. Nonpoint Source Pollution Assessment Report. Website. http://nonpoint.deq.state.la.us/assess39.html.

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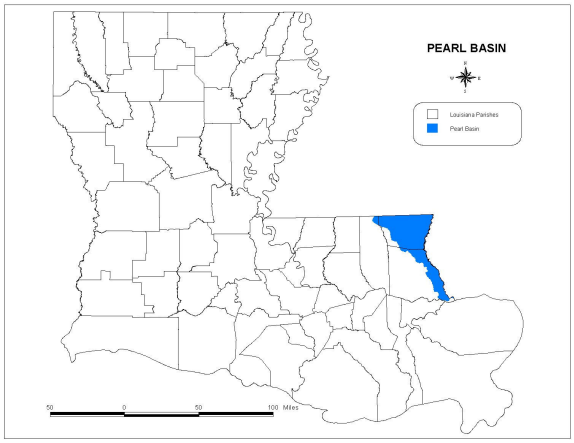
U.S. ARMY CORPS OF ENGINEERS. 1998. Water resources development in Louisiana. U.S. Army Corps of Engineers, New Orleans District. 191 pp.

VIDRINE, M. F. 1993. The historical distribution of freshwater mussels in Louisiana. Gail Q. Vidrine Collectables. Eunice, LA. 225 pp.

g. Pearl Basin

General Description:



The Pearl River basin's drainage area covers about 7,800 square miles (Storm 2005) and lies within two states, Mississippi and Louisiana. Land use within the basin is predominately agriculture and forestry. Urbanization is steadily increasing as residents from the metropolitan areas of New Orleans continue to emigrate into St. Tammany and Washington Parishes.

The East Pearl River system is one of Louisiana and Mississippi's principal rivers, draining an approximate area of 8,760 square miles. The river divides into distinct channels west of Picayune, Mississippi where the main stream is known as the West Pearl River. The East Pearl River is formed by a confluence of the Hobolochitto Creek and Farrs Slough, and forms the boundary between Mississippi and Louisiana. The East Pearl River drains into Lake Borgne and eventually into the Mississippi Sound.

The Pearl River Basin is the most unaffected of all the state's river basins, however future development pressures and changes in land use practices could seriously degraded the habitat in this basin. Main channel and side channel habitats throughout the basin are threatened by the operation of dams or reservoirs. Threats such as the headwater dam (Ross Barnett Reservoir) at Jackson, Mississippi have changed normal historic flow patterns in the lower Pearl Basin. Future proposals for new reservoirs south of Jackson will further compound the interruption of normal flow patterns to that portion of the river below these reservoirs. Degradation of other habitats (tributaries, backwaters, and swamps) have been less severe primarily due to a lack of accessibility to most of these areas. Erosion and sedimentation, aided by farming practices, are the prime contributors to non-point source pollution effecting habitat loss. Historic mining practices on the Pearl and Bogue Chitto Rivers have interfered with the spawning cycle of the Alabama Shad. Removal of sand and gravel has greatly reduced the available substrates necessary for this species reproduction.

The COE project "Pearl River Navigation Channel" completed in the 1950's has had a lasting impact on the habitat of the basin. The placement of 2 low water sills and 3 navigation locks on the Pearl River have altered the historic migration routes and the overall life cycles of the Gulf Sturgeon. The Alabama Shad, which has experienced significant declines in the last century, has had its spawning routes blocked by the placement of these structures. Historic Paddlefish spawning and rearing areas have been altered due to these structures. With the decline of commercial traffic in the 70's, maintenance dredging was suspended and the locks were placed in caretaker status. A

request by local business interests in Slidell and Bogalusa to reevaluate the economic and environmental feasibility of maintaining the locks and navigation channel was submitted to the COE in the 80's and dredging of the river began in 1989. However, dredging was discontinued due to environmental concerns and the project is currently awaiting concurrence from federal and state regulators before it will continue (COE 1998).

Construction of Interstate-10 has had an impact on the bottomlands located along the Pearl River north of the highway. The ground-level sections of the highway act as a dam and have altered the natural hydrology and substantially increased sedimentation in many areas within Pearl River WMA.

The Pearl Basin, along with the Pontchartrain Basin, contains some of the greatest aquatic species diversity found in Louisiana. There are roughly 108 species of freshwater fishes (W. Kelso, personal communication), 20 species of mussels (Vidrine 1993), and 15 species of crawfish (J. Walls, personal communication) found within the Pearl Basin.

Water Quality:

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 10% of the 23 water body subsegments within the basin were fully supporting their three primary designated uses. However, 78% of the subsegments were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, nutrients, fecal coliform, organic enrichment and low concentration of dissolved oxygen, pH levels, and turbidity. The suspected sources of the water quality problems include: home sewage systems, agriculture (particularly pasturelands), silviculture, urban storm water runoff, and surface mining.

PEARL BASIN SPECIES OF CONSERVATION CONCERN (26)		
CRUSTACEANS	Silverjaw Minnow	Elephant-Ear
Ribbon Crawfish	River Redhorse	Mississippi Pigtoe
Plain Brown Crawfish	Frecklebelly Madtom	Inflated Heelsplitter
Flatwoods Digger	Crystal Darter	Southern Rainbow
	Channel Darter	
FRESHWATER FISH	Freckled Darter	**REPTILES**
Gulf Sturgeon	Pearl Darter	Alligator Snapping Turtle
Paddlefish	Gulf Logperch	Ringed Map Turtle
Alabama Shad		Pascagoula Map Turtle
Flagfin Shiner	**MUSSELS**	Mississippi Diamond-backed Terrapin
Bluenose Shiner	Rayed Creekshell	Stripe-necked Musk Turtle

Priority Species Research and Survey Needs:

Fish: Conduct surveys to determine the presence of species of conservation concern within their historic ranges in the basin.

Crustaceans: Continue surveys to update historic locality records in order to update abundance and distribution data for inclusion in the LNHP database.

Mussels: Surveys are needed to update historic occurrence records and develop new baseline data on current species population distributions and abundance.

Alligator Snapping Turtle: Baseline mark-release data were obtained during the late 1990s. New surveys are needed to obtain population trend data for this species.

Species Conservation Strategies:


Alabama Shad

1. Alabama Shad: Reintroduce species to its original Louisiana drainages.
2. Gulf Sturgeon:
   - Implement conservation actions recommended in SWG project T8 (LDWF 2005) and recovery plan (USFWS et al. 1995c).
   - Prepare "white paper" on the importance of access for sturgeon to spawning areas in the Pearl Basin. Meet with COE and USFWS to discuss fish passage issues.
3. Mussels: Implement conservation and management strategies from SWG project T10 upon completion.
4. Support and expand the fish passage study currently being conducted in the Mississippi portion of the Pearl River.
5. Develop a comprehensive survey methodology for the Pearl River and its tributaries to fill data gaps for this critical drainage basin.

Threats Affecting Basin:

The following table illustrates the threats identified for the Pearl Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

	Threat						
Source of Threat	Altered Composition/ Structure	Altered Water Quality	Habitat Destruction or Conversion	Habitat Disturbance	Modification of Water Levels; Changes in Natural Flow Patterns	Nutrient Loading	Sedimentation
Channelization of rivers or streams	XXX	XXX	XXX	XXX	XXX		XXX
Construction of ditches, drainage or diversion systems	XXX	XXX		XXX	XXX	XXX	XXX
Construction of navigable waterways	XXX		XXX				
Incompatible forestry practices	XXX	XXX		XXX	XXX		XXX
Mining practices	XXX	XXX		XXX	XXX		XXX
Operation of dams or reservoirs	XXX	XXX	XXX	XXX	XXX		XXX
Operation of drainage or diversion systems	XXX		XXX		XXX		XXX

Basin Conservation Strategies:

1. Coordinate with COE, MDWFP, MDEQ, LDEQ, NRCS, TNC and others to develop a comprehensive management strategy for the entire Pearl River.
2. Partner with LDEQ, the Lake Pontchartrain Basin Foundation (LPBF), TNC to address water quality issues in the Pearl River Basin.
3. Develop an internal procedure to distribute information on proposed reservoirs to LDWF district biologists and incorporate their input into official LDWF comments.
4. Support establishing levee breaks or set-backs to develop or replenish backwater areas.
5. Develop programs to eliminate entanglement gear in the Pearl River and its tributaries.
6. Encourage alternative bridge design to lessen impacts to aquatic habitats (pilings vs. culverts).
7. Promote public awareness concerning soil erosion problems resulting from construction activities. Provide the public with contact information (e.g., hotline number) to report violations/problem sites.

References:

BART, H., AND R. SUTTKUS. 1996. Status survey of the Pearl darter (*Percina aurora*) in the Pascagoula River system. Museum Technical Report No. 45, Mississippi Department of Wildlife, Fisheries and Parks. 13 pp.

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U.S. ARMY CORPS OF ENGINEERS. 1998. Water resources development in Louisiana. U.S. Army Corps of Engineers, New Orleans District. 191 pp.

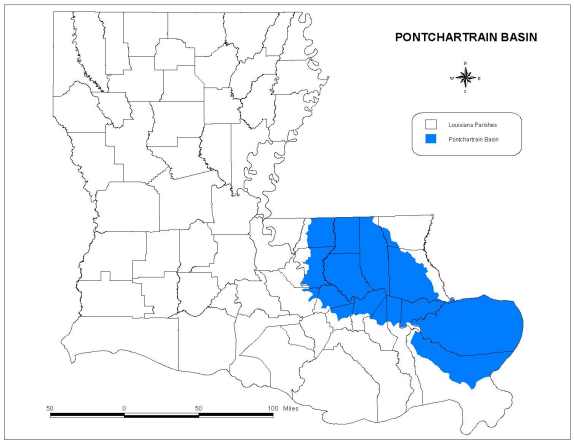
VIDRINE, M. F. 1993. The historical distribution of freshwater mussels in Louisiana. Gail Q. Vidrine Collectables. Eunice, LA. 225 pp.

h. Pontchartrain Basin

General Description:


Gulf sturgeon

The Lake Pontchartrain Basin is a 4,700 square mile watershed in southeast Louisiana and southwest Mississippi. The topography of the basin ranges from more than 300 feet above sea level in the rolling hills along the Louisiana and Mississippi state line to sea level throughout the coastal wetlands to more than 10 feet below sea level in some areas of New Orleans.



The northern half of the basin is commonly referred to as the Florida Parishes and it contains all or portions of 7 parishes: East Baton Rouge, East Feliciana, Livingston, St. Helena, St. Tammany, Tangipahoa, and Washington. Many rivers drain the Florida Parishes, introducing fresh water into Lakes Maurepas, Pontchartrain and Borgne. The largest of these, the Pearl and Amite Rivers, have headwaters in Mississippi. The rivers of this basin have eroded and incised the uplands to form distinct river valleys. Lakes Maurepas, Pontchartrain and Borgne form a shallow brackish receiving basin for fresh water from the Amite, Tickfaw, Blind, Tangipahoa, Tchefuncte, and Pearl Rivers, as well as Bayou Lacombe and Bayou Bonfouca. Fresh water is also introduced through regional drainage and diversion canals while salt water enters these lakes from the Gulf of Mexico via the Mississippi Sound, Mississippi River Gulf Outlet (MRGO), Chef Pass, and Rigolets Pass. The Mississippi River Deltaic Plain lies to the south of these lakes.

Land use within this basin is varied, ranging from high-density urban areas that drain through metropolitan Baton Rouge and New Orleans drainage canals to rural pastures and dairies in the Florida Parishes. In 1995, the LPBF released a comprehensive management plan for the basin that details management strategies to address sewage and agricultural runoff, stormwater runoff, and saltwater intrusion/wetland loss.

The Pontchartrain Basin, along with the Pearl Basin, contains some of the greatest aquatic species diversity found in the state. There are roughly 109 species of freshwater fishes (W. Kelso, personal communication), 35 species of mussels (Vidrine 1993), and 13

species of crawfish (J. Walls, personal communication) found within the Pontchartrain Basin.

Water Quality:

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 37% of the 84 water body subsegments within the basin were fully supporting their three primary designated uses. However, 48% of the subsegments were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, nutrients, benzo(a)pyrene (a polycyclic aromatic hydrocarbon or PAH), fecal coliform, non-native aquatic plants, organic enrichment and low concentration of dissolved oxygen, oil and grease, dissolved and suspended solids, pH levels, sedimentation/siltation, and turbidity. The suspected sources of the water quality problems include: home sewage systems, agriculture (particularly pasturelands), silviculture, urban development, urban storm water runoff, industry, and sand and gravel mining.

PONTCHARTRAIN BASIN SPECIES OF CONSERVATION CONCERN (19)		
CRUSTACEANS	River Redhorse	Alabama Hickorynut
Ribbon Crawfish	Broadstripe Topminnow	Mississippi Pigtoe
Plain Brown Crawfish	Gulf Logperch	Inflated Heelsplitter
Flatwoods Digger		Southern Rainbow
	MUSSELS	
FRESHWATER FISH	Rayed Creekshell	**REPTILES**
Gulf Sturgeon	Elephant-Ear	Alligator Snapping Turtle
Paddlefish	Southern Pocketbook	Mississippi Diamond-backed Terrapin
Flagfin Shiner	Southern Hickorynut	

Priority Species Research and Survey Needs:

Mussels: Surveys are needed to update historic records and develop new baseline data on current species population distributions and abundance.

Alligator Snapping Turtle: Baseline mark-release data were obtained during the late 1990s. New surveys are needed to obtain population trend data for this species.

Species Conservation Strategies:

1. Implement species conservation strategies detailed in the LPBF plan (Maygarden et al. 2004).
2. Mussels:
   - Inflated Heelsplitter: Work with sand and gravel interests to restore and maintain habitat within the Amite River.
   - Implement conservation and management strategies from SWG project T10 upon completion.

Threats Affecting Basin:

The following table illustrates the threats identified for the Pontchartrain Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

	Threat						
Source of Threat	Altered Composition/ Structure	Altered Water Quality	Competition for Resources	Habitat Disturbance	Modification of Water Levels; Changes in Natural Flow Patterns	Nutrient Loading	Sedimentation
Channelization of rivers or streams	XXX	XXX		XXX	XXX		XXX
Construction of ditches, drainage or diversion systems	XXX	XXX		XXX	XXX		XXX
Conversion to agriculture or other forest types				XXX			
Crop production practices		XXX				XXX	
Development/maintenance of pipelines, roads or utilities				XXX			
Incompatible forestry practices	XXX	XXX		XXX			XXX
Invasive/alien species			XXX				
Livestock production practices						XXX	
Mining practices	XXX	XXX		XXX	XXX		XXX
Operation of dams or reservoirs	XXX	XXX			XXX		XXX
Operation of drainage or diversion systems		XXX		XXX	XXX		XXX
Recreational use/vehicles		XXX					XXX
Residential development		XXX				XXX	XXX
Shoreline stabilization				XXX			

Basin Conservation Strategies:

1. Develop a comprehensive stream survey methodology for the Pontchartrain Basin.
2. Develop partnerships with regulatory agencies to share data on habitat threats and to ensure compliance of existing regulations.
3. Work with LPBF and NRCS to promote conservation efforts/water quality/education/etc.
4. Implement habitat conservation strategies presented in LPBF plan.

References:

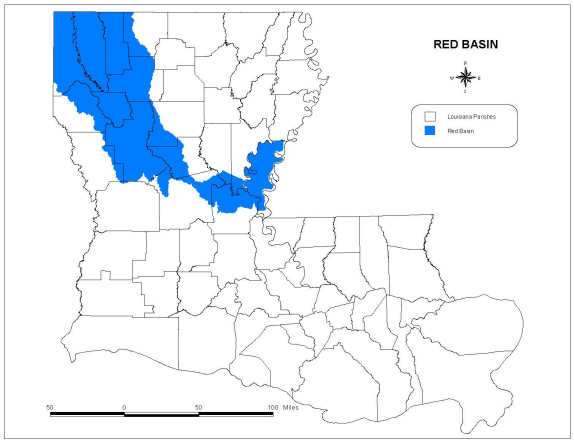
LOUISIANA DEPARTMENT ENVIRONMENTAL QUALITY. 2004. Louisiana Water Quality Inventory: Integrated Report. Water Quality Assessment Division, Standards Assessment and Nonpoint Source Section. Baton Rouge, LA. 110 pp.

MAYGARDEN, D., L. BURCH, L. SMITH, N. MCINNIS, AND R. MARTIN. 2004. Lake Pontchartrain Estuary Conservation Area Plan. The Nature Conservancy. Northshore Field Office. Covington, LA.

VIDRINE, M. F. 1993. The historical distribution of freshwater mussels in Louisiana. Gail Q. Vidrine Collectables. Eunice, LA. 225 pp.

i. Red Basin

General Description:



The Red River is one of Louisiana's major river systems and is located in the Mississippi drainage basin. The headwaters of the Red River begin in Curry County, New Mexico and it ends 1,360 miles downstream at the Mississippi River. The Red River watershed is 69,200 square miles (44,287,823 acres) (Ken Guidry, personal communication) and receives drainage from 5 states including New Mexico, Texas, Oklahoma, Arkansas, and Louisiana. The Red River drains approximately 7,760 square miles within Louisiana (COE 1998).

The Red River enters Louisiana from Arkansas in the northwest portion of the state and follows a southeasterly course, passing through or forming the boundary of 10 parishes, until it reaches its mouth at the Mississippi River. Shreveport and Alexandria are the principle cities located along the river. The Red River received its name from the high concentration of red soil present in the river following flood periods. Much of the basin is forested and agriculture lands are primarily located within the Red River's historic floodplain.

Navigational improvements on the Red River began in the early part of the 19th century. The most recent improvements, part of the $1.9 billion Red River Waterway Project (RRWP) authorized by Congress with the Rivers and Harbors Act of 1968, consisted of dredging a channel 9 feet deep and 200 feet wide and adding a series of five lock and dam complexes to improve navigation from the Mississippi River to Shreveport. Other improvements within the RRWP consisted of developing a comprehensive plan for bank stabilization from the Denison Dam on the Texas/Oklahoma boarder to the Mississippi River.

There are roughly 99 species of freshwater fishes (W. Kelso, personal communication), 36 species of mussels (Vidrine 1993), and 18 species of crawfish (J. Walls, personal communication) found within the Red Basin.

Water Quality:

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 23% of the 71 water body subsegments within the basin were fully supporting their three primary designated uses. However, 75% of the subsegments were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality

problems include: metals, nutrients, polychlorinated biphenyls (PCBs), fecal coliform, non-native aquatic plants, organic enrichment and low concentration of dissolved oxygen, dissolved and suspended solids, pH levels, sedimentation/siltation, and turbidity. The suspected sources of the water quality problems include: forestry activities, crop production, pasture lands, home sewage systems, land development and urban runoff, channelization or dredging of streams, removal of riparian vegetation, and road construction.

RED BASIN SPECIES OF CONSERVATION CONCERN (17)		
CRUSTACEANS	Chub Shiner	**MUSSELS**
Kisatchie Painted Crawfish	Suckermouth Minnow	Louisiana Pearlshell
Javelin Crawfish	Bluehead Shiner	Louisiana Pigtoe
Vernal Crawfish	Blue Sucker	
Twin Crawfish	River Redhorse	**REPTILES**
	Crystal Darter	Alligator Snapping Turtle
FRESHWATER FISH	Western Sand Darter	Ouachita Map Turtle
Pallid Sturgeon		
Paddlefish		

Louisiana pearlshell

Priority Species Research and Survey Needs:


Louisiana Pearlshell

Crystal Darter: First recorded in the Red River in 2002, extending the documented range of this species westward (Pezold and Antwine 2003). Continue to survey its preferred habitat to determine its current distribution.

Louisiana Pearlshell: Research needed on host fish species.

Alligator Snapping Turtle: Baseline mark-release data were obtained during the late 1990s. New surveys are needed to obtain population trend data for this species.

Species Conservation Strategies:

1. Crustaceans: Develop a protocol to monitor abundance, distribution patterns, and habitat quality using baseline data obtained in SWG project T10 (Walls 2003).
2. Louisiana Pearlshell:
   - Develop a survey protocol to monitor the remaining populations, especially in streams located within the KNF.
   - Partner with the USFWS to implement conservation recommendations in the recovery plan (USFWS 1989).
   - Work with landowners to maintain water quality in the streams inhabited by the Louisiana pearlshell.

Threats Affecting Basin:

The following table illustrates the threats identified for the Red Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

	Threat							
Source of Threat	Altered Composition/ Structure	Competition for Resources	Habitat Destruction or Conversion	Habitat Disturbance	Modification of Water Levels; Changes in Natural Flow Patterns	Nutrient Loading	Sedimentation	Toxins/ Contaminants
Channelization of rivers or streams	XXX		XXX	XXX	XXX		XXX	
Commercial/industrial development							XXX	XXX
Construction of ditches, drainage or diversion systems	XXX					XXX	XXX	
Construction of navigable waterways	XXX				XXX		XXX	
Crop production practices	XXX		XXX			XXX	XXX	
Dam construction	XXX		XXX	XXX	XXX	XXX	XXX	
Incompatible forestry practices			XXX	XXX			XXX	
Industrial discharge								XXX
Invasive/alien species	XXX	XXX	XXX	XXX				
Levee or dike construction	XXX		XXX				XXX	
Management of/for certain species			XXX	XXX				
Operation of dams or reservoirs	XXX		XXX	XXX	XXX		XXX	
Operation of drainage or diversion systems	XXX		XXX				XXX	

Basin Conservation Strategies:

1. Develop a comprehensive survey methodology for the Red River Basin.
2. Conduct a detailed inventory of the Red River above Shreveport that focuses on habitats and species of conservation concern.
3. Develop partnerships with regulatory agencies to share data on habitat threats and to ensure compliance of existing regulations.
4. Work with LANSTF to identify and address threats related to invasive species.
5. Prepare educational material on potential impacts invasive species to the Red River.
6. Continue LDWF involvement in the environmental review process for all river basin related projects and identify appropriate mitigation methods.
7. Develop education and outreach programs with NRCS to reduce sediments and nutrient loading within the Red River Basin.

References:

LOUISIANA DEPARTMENT ENVIRONMENTAL QUALITY. 2004. Louisiana Water Quality Inventory: Integrated Report. Water Quality Assessment Division, Standards Assessment and Nonpoint Source Section. Baton Rouge, LA. 110 pp.

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U.S. ARMY CORPS OF ENGINEERS. 1998. Water resources development in Louisiana. U.S. Army Corps of Engineers, New Orleans District. 191 pp.

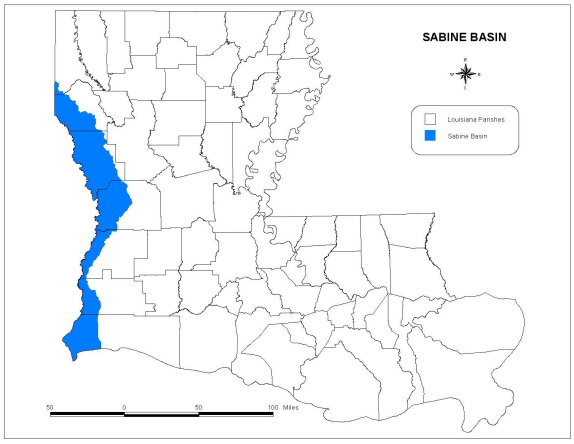
U.S. FISH AND WILDLIFE SERVICE. 1989. Louisiana pearlshell (*Margaritifera hembeli*) recovery plan. U. S. Fish and Wildlife Service. Jackson, MS.

VIDRINE, M. F. 1993. The historical distribution of freshwater mussels in Louisiana. Gail Q. Vidrine Collectables. Eunice, LA. 225 pp.

WALLS, J. G. 2003. Survey of localities fourteen threatened crawfish species in Louisiana. Final report to the Louisiana Natural Heritage Program. Louisiana Department of Wildlife and Fisheries. Baton Rouge, LA.

j. Sabine Basin

General Description:



The Sabine River arises in northern Hunt County and eastern Collin and Rockwall counties in north central Texas, and flows in an easterly direction to the Texas and Louisiana boundary near Logansport, Louisiana. The Sabine flows as boundary waters between the 2 states for some 270 river miles to the Gulf of Mexico. The Sabine River drains an area of approximately 9,700 square miles of which, 7,190 square miles are above the Toledo Bend Reservoir (A.I.D. Associates 1981). Roughly 2,510 square miles of drainage are situated below the dam which is located at river mile 200. The entire basin drains 3,257 square miles within the state. The Toledo Bend Reservoir was constructed in the 1960's and became operational in 1969. Operation of the hydroelectric plant has affected water flows on the lower portions of the river since that time. Sand and silt are the predominant substrates below the dam to the Gulf of Mexico.

The northern and central portions of the basin are primarily forested with scattered agriculture lands throughout. Most of the basin is pinelands with the majority of hardwoods located along principle drainages. Along the coastal zone almost all of the freshwater marsh was converted to intermediate and brackish marsh by the late 1970s as a result of saltwater intrusion and increased tidal influence (LaCoast 2005).

There are roughly 89 species of freshwater fishes (W. Kelso, personal communication), 33 species of mussels (Vidrine 1993), and 13 species of crawfish (J. Walls, personal communication) found within the Sabine Basin.

Water Quality:

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 47% of the 19 water body subsegments within the basin were fully supporting their three primary designated uses. 68% of the subsegments were supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, fecal coliform, non-native aquatic plants, organic enrichment and low concentration of dissolved oxygen, and turbidity. The suspected sources of the water quality problems include: major industrial point sources, harvesting/reforestation, surface mining, agriculture, and urban runoff.

SABINE BASIN SPECIES OF CONSERVATION CONCERN (14)		
CRUSTACEANS	Suckermouth Minnow	Texas Heelsplitter
Calcasieu Painted Crawfish	Western Sand Darter	Southern Creekmussel
Kisatchie Painted Crawfish	Bigscale Logperch	
Twin Crawfish		**REPTILES**
	MUSSELS	Alligator Snapping Turtle
FRESHWATER FISH	Sandbank Pocketbook	Sabine Map Turtle
Paddlefish	Louisiana Pigtoe	Mississippi Diamond-backed Terrapin

Priority Species Research and Survey Needs:

Western Sand Darter and Suckermouth Minnow: Surveys are needed to assess their current distribution and abundance.

Mussels: Surveys are needed to update historic records and develop new baseline data on current species population distributions and abundance.

Crustaceans: Continue surveys to update historic locality records in order to update abundance and distribution data for inclusion in the LNHP database.

Mississippi Diamondback Terrapin: The status of this species is unknown. Endangered Species Act candidate status is pending. Evaluate trawl data from LDWF Marine Fisheries trawl surveys for distribution estimates. Initiate surveys in vicinity of recent trawl captures to assess current population abundance.

Species Conservation Strategies:

1. Western Sand Darter and Suckermouth Minnow: Develop partnerships with Texas Department of Parks and Wildlife to monitor populations of these species throughout the Sabine drainage basin.

Threats Affecting Basin:

The following table illustrates the threats identified for the Sabine Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

Source of Threat	Threat: Altered Composition/ Structure	Altered Water Quality	Change in Land- Use Practices	Habitat Destruction or Conversion	Habitat Disturbance	Loss of Genetic Diversity	Modification of Water Levels; Changes in Natural Flow Patterns	Salinity Alteration	Sedimentation	Toxins/ Contaminants
Channelization of rivers or streams	XXX	XXX						XXX		
Commercial/industrial development		XXX					XXX			
Construction of ditches, drainage or diversion systems							XXX	XXX		
Conversion to agriculture or other forest types			XXX	XXX	XXX				XXX	
Crop production practices			XXX		XXX					
Dam construction	XXX			XXX	XXX		XXX			
Development/maintenance of pipelines, roads or utilities					XXX					
Excessive groundwater withdrawal							XXX			
Incompatible forestry practices					XXX					
Industrial discharge										XXX
Invasive/alien species	XXX				XXX	XXX				
Operation of dams or reservoirs	XXX	XXX				XXX	XXX	XXX	XXX	
Operation of drainage or diversion systems							XXX			
Residential development			XXX	XXX	XXX		XXX			

Basin Conservation Strategies:

1. Support initiatives and programs that help reduce siltation and sedimentation throughout the basin.
2. Work with LANSTF to identify and address threats related to invasive species.
3. Develop partnerships with regulatory and other agencies to share data on habitat threats.
4. Develop an internal procedure to distribute information on proposed reservoirs to LDWF district biologists and incorporate their input into official LDWF comments.

References:

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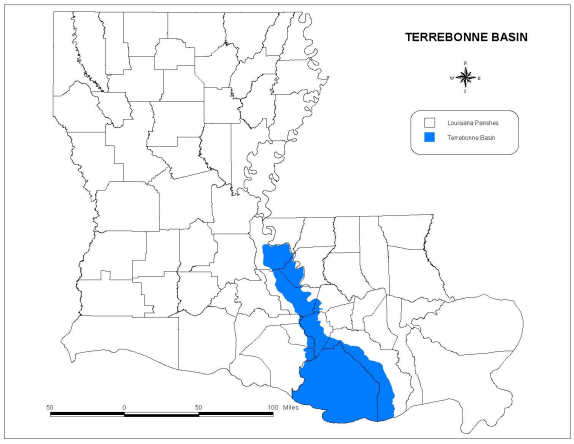
VIDRINE, M. F. 1993. The historical distribution of freshwater mussels in Louisiana. Gail Q. Vidrine Collectables. Eunice, LA. 225 pp.

k. Terrebonne Basin

General Description:



The Terrebonne Basin covers approximately 1,712,500 acres in south-central Louisiana (LCWRCTF 1993), bordered by Bayou Lafourche to the east, the Atchafalaya Basin floodway to the west, the Mississippi River to the north, and the Gulf of Mexico to the south. It includes all of Terrebonne Parish and parts of Lafourche, Assumption, St. Martin, St. Mary, Iberville, and Ascension Parishes.

The extreme northern portion of the basin is primarily agriculture lands which continue south along its eastern edge within the historic floodplains of the Mississippi River and Bayou Lafourche. The western half of the basin consists of bottomland hardwood forests and cypress-tupelo-blackgum swamps. The coastal zone consists of fresh and intermediate marsh inland to brackish and salt marsh near the bays and gulf (LaCoast 2005). Approximately 729,000 acres of the Terrebonne Basin are wetlands which consist of about 21% freshwater swamp and 79% marsh (LaCoast 2005). The two primary water sources that enter this system are rain water and flood water from the Atchafalaya River containing nutrient-rich sediments which inundate the southwestern coastal marshes (LaCoast 2005).

There are roughly 57 species of freshwater fishes (W. Kelso, personal communication), 12 species of mussels (Vidrine 1993), and 10 species of crawfish (J. Walls, personal communication) found within the Terrebonne Basin.

Water Quality:

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 31% of the 60 water body subsegments within the basin were fully supporting their three primary designated uses. However, 66% of the subsegments were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, pesticides, nutrients, fecal coliform, non-native aquatic plants, organic enrichment and low concentration of dissolved oxygen, dissolved and suspended solids, pH levels, sedimentation/siltation, and turbidity. The suspected sources of the water quality problems include: non-irrigated crop production, pasture land, urban runoff, hydromodification, combined sewers and unsewered areas, surface runoff, and spills.

TERREBONNE BASIN SPECIES OF CONSERVATION CONCERN (3)	
FRESHWATER FISH	**REPTILES**
Paddlefish	Alligator Snapping Turtle
	Mississippi Diamond-backed Terrapin

Priority Species Research and Survey Needs:

Alligator Snapping Turtle: Baseline mark-release data were obtained during the late 1990s. New surveys are needed to obtain population trend data for this species.

Mississippi Diamondback Terrapin: The status of this species is unknown. Endangered Species Act candidate status is pending. Evaluate trawl data from LDWF Marine Fisheries trawl surveys for distribution estimates. Initiate surveys in vicinity of recent trawl captures to assess current population abundance.

Species Conservation Strategies:

1. Develop data base containing baseline data on current composition and abundance of all species with a focus on species of conservation concern.
2. Sampling is needed to identify trends in range and abundance of native and invasive species throughout the Terrebonne Basin.

Threats Affecting Basin:
The following table illustrates the threats identified for the Terrebonne Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

	Threat								
Source of Threat	Altered Composition/ Structure	Altered Water Quality	Change in Land Use Practices	Competition for Resources	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns	Nutrient Loading	Sedimentation
Channelization of rivers or streams		XXX			XXX		XXX		
Construction of ditches, drainage or diversion systems		XXX	XXX				XXX		XXX
Construction of navigable waterways						XXX	XXX		XXX
Conversion to agriculture or other forest types			XXX				XXX	XXX	XXX
Crop production practices		XXX	XXX				XXX	XXX	XXX
Development/maintenance of pipelines, roads or utilities									XXX
Industrial discharge		XXX						XXX	
Invasive/alien species				XXX					
Levee or dike construction	XXX	XXX	XXX				XXX	XXX	XXX
Oil or gas drilling						XXX	XXX		
Residential development		XXX	XXX				XXX		XXX

Basin Conservation Strategies:

1. Promote oil spill prevention regulations SPC and natural resource response mechanisms NRDA.
2. Promote the use of BMP's for water runoff. Promote enforcement of sanitary regulations.
3. Promote methods to restore historical flow regimes within the Terrebonne Basin.
4. Work with LDEQ and USGS to increase monitoring of nutrient inputs and overall water quality within the Terrebonne Basin.
5. Support research efforts.
6. Prepare educational material on the potential impacts of invasive species to the Terrebonne Basin.
7. Coordinate with the Atchafalaya Basin Program (LDNR) and BTNEP to abate identified threats to this basin.

References:

LACOAST. 2005. Louisiana Coastal Restoration and Conservation Task Force Website. Terrebonne Basin. http://www.lacoast.gov/geography/te/index.asp.

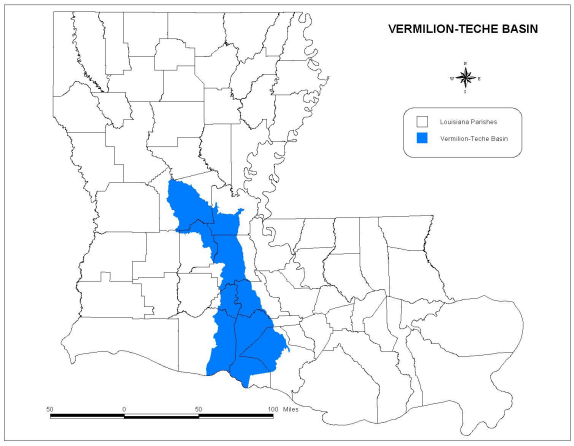
LOUISIANA COASTAL WETLANDS RESTORATION AND CONSERVATION TASK FORCE. 1993. Louisiana Coastal Restoration Plan—Terrebonne Basin, appendix E. Website. http://www.lacoast.gov/reports/cwcrp/1993/TerreApndxE.pdf.

LOUISIANA DEPARTMENT ENVIRONMENTAL QUALITY. 2004. Louisiana Water Quality Inventory: Integrated Report. Water Quality Assessment Division, Standards Assessment and Nonpoint Source Section. Baton Rouge, LA. 110 pp.

VIDRINE, M. F. 1993. The historical distribution of freshwater mussels in Louisiana. Gail Q. Vidrine Collectables. Eunice, LA. 225 pp.

l. Vermilion-Teche Basin

General Description:



The Vermilion-Teche basin's drainage area covers approximately 4,047 square miles. Habitats within the basin range from the upland pine forests, northwest of Alexandria, to agriculture lands consisting primarily of corn and soybeans, in its northern portion, and rice and sugarcane in its central and southern portion. The coastal zone is mostly freshwater marsh from Bayou Cypremort east to LA Hwy 317. Intermediate and brackish marsh occupy all of the coastal zone west of Bayou Cypremort with small areas of salt marsh on Marsh Island WMA and Paul J. Rainey Wildlife Sanctuary.

Water from the Atchafalaya River is diverted into the Vermilion-Teche River Basin through the Bayou Teche water project. Authorized by the Flood Control Act of 1966, this structure allows the diversion of supplemental fresh water from the Atchafalaya River upstream of Krotz Springs to the head of Bayou Teche at Port Barre. The supplemental fresh water is distributed among Bayou Teche, the Vermilion River, and the west side borrow pit along the Atchafalaya basin protection levee for municipal, industrial, irrigation, and water-quality control uses (COE 1998).

There are roughly 59 species of freshwater fishes (W. Kelso, personal communication), 30 species of mussels (Vidrine 1993), and 17 species of crawfish (J. Walls, personal communication) found within the Vermilion-Teche Basin.

Water Quality:

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 7% of the 44 water body subsegments within the basin were fully supporting their three primary designated uses. However, 91% of the subsegments were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, pesticides, nutrients, fecal coliform, non-native aquatic plants, organic enrichment and low concentration of dissolved oxygen, dissolved and suspended solids, sedimentation/siltation, and turbidity. The suspected sources of the water quality problems include: crop production, aquaculture, urban runoff, petroleum activities, hydromodification, surface mining, construction, and dredging.

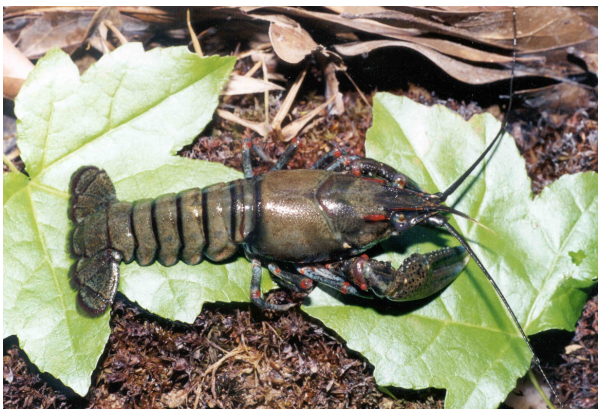
VERMILION-TECHE BASIN SPECIES OF CONSERVATION CONCERN (8)		
CRUSTACEANS	**FRESHWATER FISH**	**REPTILES**
Teche Painted Crawfish	Paddlefish	Alligator Snapping Turtle
Kisatchie Painted Crawfish		Mississippi Diamond-backed Terrapin
Javelin Crawfish	**MUSSELS**	
Old Prairie Crawfish	Louisiana Pearlshell	

Priority Species Research and Survey Needs:

Paddlefish: Continue with stock assessment surveys.

Alligator Snapping Turtle: Baseline mark-release data were obtained during the late 1990s. New surveys are needed to obtain population trend data for this species.

Mississippi Diamondback Terrapin: The status of this species is unknown. Endangered Species Act candidate status is pending. Evaluate trawl data from LDWF Marine Fisheries trawl surveys for distribution estimates. Initiate surveys in vicinity of recent trawl captures to assess current population abundance.



Kisatchie Painted Crawfish

Species Conservation Strategies:

1. Develop database containing baseline data on current composition and abundance of all species with a focus on species of conservation concern.
2. Sampling is needed to identify trends in range and abundance of native and invasive species throughout the Vermilion-Teche Basin.

Threats Affecting Basin:

The following table illustrates the threats identified for the Vermilion-Teche Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

Source of Threat	Threat: Altered Composition/ Structure	Change in Land Use Practices	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns	Nutrient Loading	Sedimentation	Toxins/ Contaminants
Channelization of rivers or streams	XXX		XXX		XXX	XXX	XXX	XXX	
Commercial/industrial development	XXX		XXX			XXX	XXX	XXX	XXX
Construction of ditches, drainage or diversion systems	XXX		XXX	XXX	XXX	XXX	XXX	XXX	
Construction of navigable waterways					XXX	XXX		XXX	
Conversion to agriculture or other forest types		XXX						XXX	
Crop production practices	XXX		XXX	XXX	XXX		XXX	XXX	XXX
Grazing practices							XXX		XXX
Incompatible forestry practices			XXX	XXX				XXX	
Industrial discharge			XXX				XXX		XXX
Invasive/alien species	XXX		XXX	XXX			XXX		
Levee or dike construction	XXX		XXX		XXX	XXX		XXX	
Oil or gas drilling					XXX	XXX			
Operation of dams or reservoirs	XXX		XXX			XXX	XXX		
Residential septic systems			XXX				XXX	XXX	XXX
Shoreline stabilization	XXX					XXX		XXX	

Basin Conservation Strategies:

1. Develop a comprehensive survey methodology for the Vermillion-Teche Basin.
2. Conduct a detailed inventory of the Vermillion-Teche Basin that focuses on habitats and species of conservation concern.
3. Promote methods to restore historical flow regimes within the Vermillion-Teche Basin.
4. Develop education material on BMPs for land-use practices within the Vermillion-Teche Basin.
5. Develop partnerships with regulatory and other agencies to share data on habitat threats.
6. Work with LANSTF to identify and address threats related to invasive species.
7. Prepare educational material on the potential impacts of invasive species to the Vermillion-Teche Basin.

References:

LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY. 1993. Nonpoint Source Pollution Assessment Report. Website. http://nonpoint.deq.state.la.us/assess37.html.

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VIDRINE, M. F. 1993. The historical distribution of freshwater mussels in Louisiana. Gail Q. Vidrine Collectables. Eunice, LA. 225 pp.

2. Marine Habitats

Synonyms: Coastal, Estuarine

General Description:

The following marine habitats are all submerged, primarily non-vegetated habitats and are described based on characteristics such as seafloor composition and the presence of seagrass beds. The following habitat descriptions should be considered as general descriptors in the development of threat assessments to the various habitat types and for the development of conservation actions for the species that depend upon those habitats.

a. Soft Mud Bottom


manatee

Soft Mud Bottoms are estuarine water bottoms dominated by fine, relatively unconsolidated sediments, often high in organic matter. These habitats may be heavily used by fish and invertebrate species adapted to burrowing in these sediments, as well. In lower salinity regimes, these bottoms may be vegetated by *Myriophyllum* spp. (water milfoils), *Utricularia* spp. (bladderworts), *Ruppia maritima* (widgeon grass), *Najas guadalupensis* (southern naiad) and other submerged aquatic vegetation (SAV). The presence of SAVs provides additional structure, shelter, and food sources to the animals dependent upon these habitats. SAVs are more likely to be abundant in smaller, sheltered areas of soft mud bottom, and less likely to be present or abundant in areas where wave action or other turbulence and turbidity is persistent.

Soft mud bottoms are typically high in organic matter, and also form a substrate that is suited for easy burrowing. Animals may use this substrate both as a refuge from predators and as a food source. Productivity of animal biomass may be related to allochthonous or autothonous sources, depending upon the productivity of SAVs, adjacent marshes, and phytoplankton production.

Soft mud bottoms of open lakes, bayous and bays tend to have higher levels of large predatory species (vertebrate and invertebrate) than do the more cryptic habitats of the soft mud bottoms of small ponds, marsh creeks and similar habitats. The more cryptic habitats therefore provide a more suitable area as nursery grounds for postlarvae or young juveniles. Predation within these cryptic habitats tends to be more from terrestrial sources (wading or shorebirds and mammals) than in more open-water habitats. One of the major issues associated with the ongoing changes to the geomorphology in the coastal zone is the loss of these cryptic habitats as water bodies expand and merge into larger areas, less suitable for nursery habitat.

b. Shell/Shell Hash Bottom

Shell/Shell Hash Bottoms are estuarine water bottoms with significant coverage of mollusk shells. These bottoms may have potential for settlement of oysters, barnacles, or other invertebrate larvae that require hard substrates, and also serve as shelter for fish living in cryptic environments. These relatively hard substrates may reduce shoreline erosion along shallow, sloped shorelines, providing physical protection for the adjacent marshlands. They also may cause changes in currents, creating environments that are beneficial for many species of fish and invertebrates. In very low-salinity environments, relatively few species other than some small invertebrates are able to utilize the shell as a settlement substrate, but the other values of the habitat remain.

Oysters provide the majority of the shell substrate in Louisiana, and are also a major fishery resource. Mussels, barnacles, worms, fishes, and a variety of other animals are either found in increasing abundance around oyster reefs, or are dependent upon these types of bottoms to survive. Other shell bottoms include Rangia clam and mixed shell hash. A number of bivalve mollusk species can co-exist in a single area, providing a variety of food sources and substrates to the animal communities. Shell and shell hash bottoms tend to be more resistant to erosion than mud bottoms, creating relief to the bottom and modifying tidal currents, especially near passes.

c. Hard Mud/Clay Bottom

Hard Mud/Clay Bottoms are estuarine and territorial sea water bottoms dominated by fine or coarse sediments, often relatively low in organic matter. These habitat types are often widely represented in larger lakes and bays, especially in areas where the sediments of the surrounding marshes are low in organic content. Productivity in these areas tends to be derived from terrestrial (marshland) allochthonous sources and phytoplankton.

An assumption among fishery managers in the Gulf of Mexico is that estuarine hard bottoms support more diverse, complex communities than adjacent soft bottoms. This assumption has led recently to the proliferation of recreational low profile artificial reefs. This has prompted private environmental organizations such as the Coastal Conservation Association (CCA), Recreational Fishing Research Institute (RFRI), and the LPBF in conjunction with the LDWF to construct low profile artificial reefs from limestone, shell and reef balls. Prior to large investments and efforts to create and restore historic shell

reefs, LDWF needs to get a better understanding of the real value and functionality of these hard bottom habitats to fishery and other aquatic resources.

d. Sandy Bottom


Loggerhead sea turtle
USFWS

Sandy Bottoms are estuarine and territorial sea water bottoms dominated by coarse sediments, often relatively low in organic matter. These habitats are usually maintained by relatively high energy influences (waves, currents, etc.) that remove or prevent the deposition of finer sediment fractions. As such, there is a continuum of sediment types ranging from nearly pure sand to silt or clay bottoms with a relatively small fraction of sand. High energy sand bottoms are limited to the fore-shore environments of barrier islands, and to a lesser extent to beaches of the cheniere plain. Other sandy bottoms may be found in submerged sand bars, remnants of former barrier islands, and offshore shoals. High-energy beaches are nursery areas for a unique suite of marine organisms, including the Florida pompano (*Trachinotus carolinus*), Gulf kingfish (*Menticihhrus littoralis*) and broad flounder (*Paralichthys squamilentus*).

e. State Territorial Open Water

This comprises all open waters from the beach shoreline to the limit of state jurisdiction, the "3 mile limit". Habitats range from sandy beaches and shoals in relatively high-energy environments to soft mud bottoms in low-energy environments. Oyster reef environments are found offshore in the central area of the state, offshore of Marsh Island, one of the few areas where significant offshore oyster reefs occur in the eastern United States. Generally moderate slopes prevail from the beachline outward, but very steep bottom slopes are found near the mouth of the Mississippi River. Conversely, very shallow slopes are found in the area between Vermilion Bay and Caillou Bay.

Salinities vary widely by location and by season. Near-freshwater conditions may be found near the mouths of the major rivers in high-water conditions, especially in the springtime, while salinities above 30 ppt. may be regularly found in the waters along the

Chandeleur and Timbalier Islands. Other areas of the state may have similar high salinities in years with drier conditions.

Liquefied Natural Gas Terminals in the Gulf of Mexico:

Congress passed the Marine Transportation Act of 2002 amending the Deepwater Port Act to include liquefied natural gas (LNG) terminals in the definition of deepwater ports. Oil and gas companies began to apply for new licenses to construct new terminals once the legislation was inacted. Currently there are 10 identified projects throughout the United States with 7 of these in the Gulf of Mexico and 6 in the waters offshore of Louisiana. Three licenses in the Exclusive Economic Zone offshore of Louisiana have already been granted, and 4 more in the Gulf of Mexico are currently being considered by the U.S. Department of Tranportation's Maritime Administration (MARAD).

The process for vaporizing LNG in the Gulf of Mexico deepwater ports is a one way "open loop" system. The system uses seawater at ambient temperature treated with anti-fouling chemicals to vaporize the LNG and then discharges the seawater after use. The proposed "open loop" deepwater port facilities will use 100 million to 200 million gallons of seawater per day. Fisheries scientists and managers question whether the cumulative effect of processing that volume of water for each operating facility will negatively affect plankton and benthonic marine resources and ultimately stocks of ecologically and economically important species. Existing data are not sufficient to provide a good basis for estimating impacts, and since Congress mandated a 330-day licensing period, there is not enough time during the licensing application period to obtain additional data.

Research is needed to adequately characterize benthic communities and the seasonal and diel movement of various life stages of marine animals as they migrate through the areas where LNG facilities are located. Temporal and spatial variability of patchy meroplankton resources presents a practical problem in recognizing adverse impacts should they occur. Additional research is needed to better characterize the duration of life stages of ecologically and economically important species in the northwestern Gulf of Mexico. That research would provide the information needed to refine the recruitment models used for stock assessments which in turn are used to evaluate the effects of multiple LNG facilities on commercial and recreational stocks of marine wildlife. Research into the physical oceanographic forces that drive the movement of plankton and distribution of effluents from these offshore facilities is also needed.

Some baseline studies are currently being planned. Monitoring of the effects of licensed facilities is required by MARAD and the United States Coast Guard (USCG) in consultation with the National Oceanic and Atmospheric Administration's Fisheries Service (NOAA-Fisheries). Further planning and coordination with NOAA-Fisheries and other Gulf states is needed to ensure that the studies are adequate.

MARINE SPECIES OF CONSERVATION CONCERN (19)		
MAMMALS	Diamond Killifish	Broad Flounder
Sperm Whale	Texas Pipefish	Large-scaled Spinycheek Sleeper
Fin Whale	Chain Pipefish	Goliath Grouper
West Indian Manatee	Opossum Pipefish	
	Emerald Sleeper	**REPTILES**
MARINE FISH	Violet Goby	Loggerhead Seaturtle
Saltmarsh Topminnow	Gold Brotula	Green Seaturtle
Bayou Killifish	Longfin Mako	Leatherback Seaturtle

Priority Species Research & Survey Needs:

West Indian Manatee: Initiate surveys of population sizes and distribution in Louisiana waters.

Whales and Dolphins: Continue to monitor the effects of seismic activity and marine transportation activities on whale and dolphin populations, especially near the mouth of the Mississippi River.

Fishes: Develop and test methods to evaluate species distributions, environmental influences on diversity, evenness and richness of communities, and identify abiotic factors that influence changes in offshore fish communities.

Species Conservation Strategies:

1. Manatees:
   - Incorporate recommendations of the manatee recovery plan for Louisiana populations (note: manatee population increases in recent years have been related to a lack of cold weather over the last 15 years. Severe freezes, such as those in 1984 and 1989 cause severe or total loss of the species in the state, after which it seems to re-colonize from peninsular Florida. Increased utilization of warm-water discharges from coastal power plants and industrial sources also helps with local survival of the species).
   - Intensify public awareness of manatee presence in Louisiana to encourage the public to report manatee sightings to the LNHP.
   - Continue and support the Manatee/Sea Grass Bed Program created by LNHP in 2003.
   - Continue education and public awareness of the presence of manatees in Louisiana through signs, pamphlets, and public events.
2. Evaluate methods to monitor changes in sea turtle and marine mammal populations.

Table 4.1 provides a listing of marine species of conservation concern and associated habitats.

Table 4.1. Marine species of conservation concern and the aquatic habitats in which they occur.

Marine Species		Aquatic Habitats by Salinity				Estuarine / Marine Habitats by Bottom					
COMMON NAME	SCIENTIFIC NAME	Salt Marsh	Brackish Marsh	Intermediate Marsh	Freshwater Marsh	Shell / Shell Hash Bottom	Soft Mud Bottom	Hard Mud/Clay Bottom	Submerged Aquatic Vegetation	Sandy Bottom	State Territorial Open Water
Bayou Killifish	*Fundulus pulvereus*	X	X	X	X		X		X		
Saltmarsh Topminnow	*Fundulus jenkinsi*			X	X		X		X		
Diamond Killifish	*Adinia xenica*	X	X	X	X	X			X		
Chain Pipefish	*Syngnathus louisianae*	X	X	X					X		
Texas Pipefish	*Syngnathus affinis*	X	X						X		
Opossum Pipefish	*Microphis brachyurus*		X	X					X		
Gold Brotula	*Gunterichthys longipenis*			X			X				
Emerald Sleeper	*Erotelis smaragdus*		X	X			X	X			
Large-scaled Spinycheek Sleeper	*Eleotris amblyopsis*						X				
Violet Goby	*Gobioides broussoneti*		X	X			X	X			
Broad Flounder	*Paralichthys squamilentus*							X		X	X
Goliath Grouper	*Epinephalus itajara*										X
Longfin Mako	*Isurus paucus*										X

Threats and Habitat Conservation Strategies:

Marsh loss and associated changes in wetland, estuarine, and marine habitats has occurred at extraordinary rates across the Louisiana coast within the last 50 years, and such changes are expected to continue for the foreseeable future. Additionally, as human populations continue to utilize these areas for living, transportation, industrial uses, commercial and recreational harvest of natural resources and other uses, increased and new stresses will be placed on these environments.

The following summary illustrates the threats identified for those habitat types. This represents all threats identified throughout the coastal zone where these habitats might occur. Sources of threats, as described under the terrestrial and aquatic basin systems was not defined in the same manner, as it was deemed to be less pertinent to addressing these issues.

SOFT MUD BOTTOM/ SUBMERGED AQUATIC VEGETATION

A. Marsh Degradation
1. Adopt coastal restoration strategies when developed/finalized.

B. Boating
1. Recommend maximum boat horsepower uses in particular sensitive areas such as shallow SAV beds.
2. Established marked channels in sensitive areas.
3. Educate boaters about ways to minimize impacts to SAV.

C. Dredging
1. Use existing project review process to minimize miles channeled. Mitigate for the channels impacts when they are constructed.

D. Residential Development
1. Improve zoning laws on the north shore of Lake Pontchartrain to address water quality issues.
2. Review permits to evaluate the potential impacts of proposed actions.
3. Education – generate greater public awareness of need/importance of SAVs.

SHELL/SHELL HASH BOTTOM

A. Extractive Activities
1. Identify activity windows appropriate for resource extraction to minimize impacts to wildlife. Use existing process of project reviews to identify issues during pre-application meetings.
2. Minimize spatial and temporal impacts arising from this threat. (esp. sand and gravel extraction related)
3. Work with other state/federal agencies to monitor these activities.

B. Timing and Volume of Fresh and Saltwater Releases

1. Manage man-made structures to mimic natural hydrologic systems. Conduct a review of established structures to insure they are meeting permit requirements. Recommend appropriate changes as needed.
2. Review pre-permitted marsh management plans to determine their impacts. Coordinate with LDNR and USFWS refuges to allow for tidal exchange.
3. Review proposed structures that require Coastal Use Permit (CUP) and COE permits.

C. Hypoxic Conditions

1. Support installation of low sill, raised berm, or other structure development on channel bottoms to slow high salinity encroachment in estuarine areas where hypoxia is exacerbated by stratification.

D. Channelization

1. Use existing project review process to minimize miles channeled. Mitigate when it occurs.

E. Operation of Dams/Reservoirs

1. Manage man-made structures to mimic natural hydrologic systems. Conduct a review of established structures to insure they are meeting permit requirements. Recommend appropriate changes as needed.
2. Review pre-permitted marsh management plans to determine their impacts. Coordinate with LDNR and USFWS refuges to allow for tidal exchange.
3. Review proposed structures that require CUP and COE permits.

F. Levee, Dike, and Weir Construction

1. Manage man-made structures to mimic natural hydrologic systems. Conduct a review of established structures to insure they are meeting permit requirements. Recommend appropriate changes as needed.
2. Review pre-permitted marsh management plans to determine their impacts. Coordinate with LDNR and USFWS refuges to allow for tidal exchange.
3. Review proposed structures that require CUP and COE permits.

G. Bulkheading

1. Meet with COE to encourage them to require permit for these structures. Determine if they are covered currently as nationwide permit.
2. In areas where there are local zoning laws, coordinate with local governments to identify alternative means of shoreline stabilization.
3. Promote native riparian conservation.

H. River Diversions

1. Promote natural seasonality and water flow regimes.

I. Invasive/Exotic Species

1. Adopt LANSTF plan for management and control of these species.

HARD MUD/CLAY BOTTOM

A. Dredging
1. Use existing project review process to minimize miles channeled. Mitigate when it occurs.

SANDY BOTTOM

A. Mining
1. Work with other state/federal agencies to influence these activities.

STATE TERRITORIAL OPEN WATER

A. Dredging
1. Use existing project review process to minimize miles channeled. Mitigate when it occurs.

B. Industrial Development
1. Work with LDEQ, LDNR and other state agencies to incorporate LDWF recomendations into the permitting process.
2. Fill data gaps regarding status quo of species and habitats in existing open water areas. Develop a better understanding of potential future impacts of mariculture, LNG development, and other industrial impacts in this habitat.

C. Sediment Starvation
1. Support river diversion projects.
2. Support research to identify alternative diversion techniques were needed.

D. Hypoxia
1. Continue with coastal research and monitoring to increase our understanding of the processes of hypoxia and anoxia development and their effects on vertebrate and invertebrate species populations and movements.
2. LDWF will continue to coordinate with the Gulf of Mexico Program and the Mississippi River Basin Alliance in drafting guidelines and management recommendations to address this issue. LDWF will ensure that efforts are coordinated and strategies are highly defined.
3. Support education of upstream agricultural and landscape users regarding the effects of fertilization runoff and its effects on the Gulf of Mexico and its estuaries.
4. Support development of methods to reduce discharge of excess nutrients into waters off coastal Louisiana, including floodplain management, freshwater diversions through wetlands, regulatory measures for fertilizer users, etc.

General Habitat Conservation Strategies:

1. Data Gaps – Initiate new research and monitoring projects for all marine habitats to identify their locations, assess their current condition and extent, and develop managemnt recommendations.
2. Develop conservation plans for marine habitats and incorporate BMPs for restoration activities.
3. Additional monitoring is needed to better assess impacts of navigation and access channels to public water bottoms.
4. Map distribution and community composition of SAV.
5. Additional monitoring should be included before and after implementation of projects involving hydrological modifications. Those monitoring efforts should extend for an adequate period of time to better assess habitat changes associated with those hydrological changes. Before hydrologic projects are implemented, a system-wide model of the basin (above and below the proposed footprint of the project) should be developed which includes direct and indirect impacts to existing hydrologic flows and barriers (e.g., levees, floodgates, CWPPRA projects) in the system.
6. Adequate monitoring is needed of community composition throughout the coastal zone.
7. Evaluate options to optimize the statistical power of current biological and environmental sampling designs.
8. Develop and implement workshops in cooperation with partner agencies for identification of estuarine/marine species in life history stages when they inhabit estuarine/nearshore territorial sea waters in order to enhance data quality.
9. Evaluate the distribution of existing sampling locations, especially with regard to habitat type, and develop and implement a process to ensure sampling coverage of habitats over time. Use Barataria Bay as a pilot study area for implementation.
10. Evaluate existing data to possibly identify surrogate species for monitoring cryptic species.
11. Work with university researchers to monitor and verify status of cryptic species by periodically confirming presence, habitat use, life history characteristics, etc.

Partners:

NOAA Fisheries, Gulf of Mexico Fishery Management Council, Gulf States Marine Fisheries Commission, US Fish and Wildlife Service, US Geological Survey, Barataria-Terrebonne National Estuary Program, Louisiana Department of Natural Resources, Louisiana Department of Environmental Quality, Louisiana Department of Health and Hospitals, Louisiana State University, University of New Orleans, Tulane University, University of Louisiana at Lafayette, Coastal Conservation Association, Recreational Fishing Research Institute, Lake Pontchartrain Basin Foundation.

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